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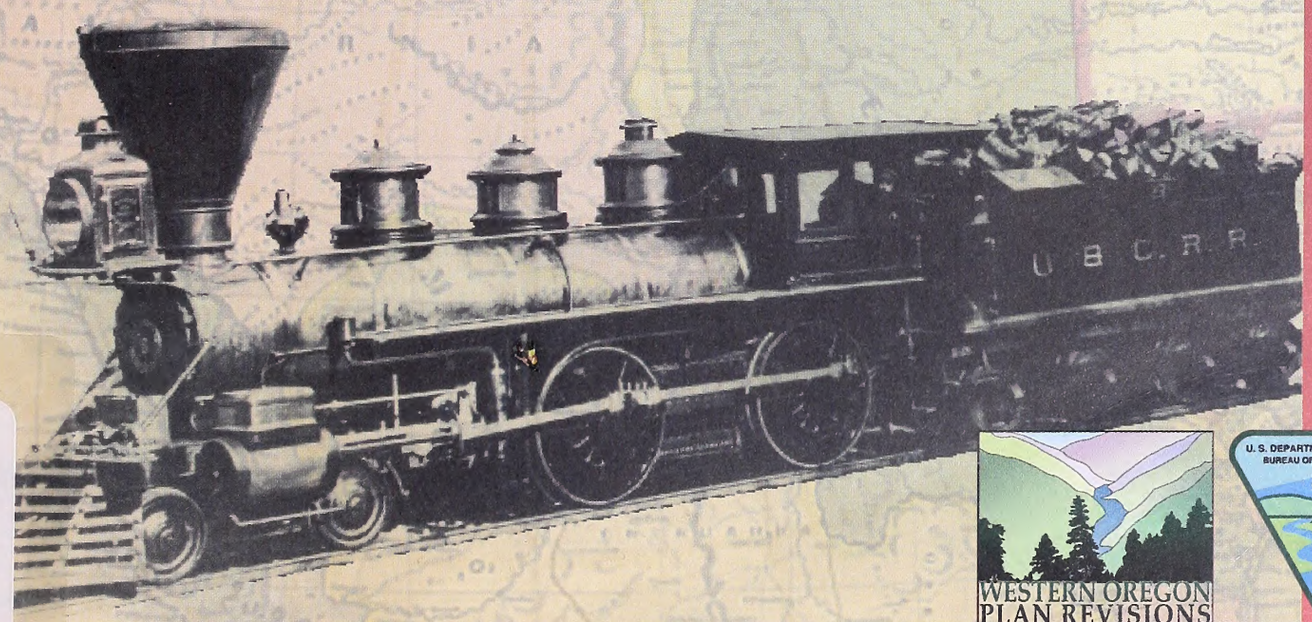
Oregon Plan Revisions

Proposed Planning Criteria and State Director Guidance



WESTERN OREGON PLAN REVISIONS

U. S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

Salem, Eugene, Roseburg, Coos Bay, Medford, and Klamath Falls Offices

February 2006

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As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The department assesses our energy and mineral resources and works to assure that their development is in the best interest of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

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Reviewers' Guide

Contents of this Document

Chapter 1: Overview
- Discusses the various aspects of planning for the BLM Western Oregon Plan Revisions.

Chapter 2: Guidance for Formulating Alternatives
- Reasonable range of alternatives established by the proposed action alternatives, as required by the National Environmental Policy Act.
- Proposed sub-alternatives addressing an appropriate subset of issues, to aid in selecting a preferred approach to the components of the alternatives.
- Proposed sensitivity analysis to identify relevant opportunity costs.

Chapter 3: Analytical Methodology for Estimating Effects of Alternatives
- Analytical assumptions, analytical methods or techniques, and data to support analytical conclusions.
- Relevant scientific references.

Note: Although you are welcome to suggest other existing data sources, analytical techniques or models, please recognize that the identified approaches are believed to be reasonable, credible, and scientifically defensible.

Chapter 4: Consistency With Other Agency Plans and Programs
- List of agencies, etc. whose plans will be considered in the analysis of consistency.

Chapter 5: Guidance for Using the Completed Management Plan
- Addresses consistency with plans and policies of other agencies, as well as use of the completed plans (including monitoring and evaluation).

Appendix A lists key personnel, and Appendix B provides a glossary of terms used in the planning process and in this document.

What You Can Do

As you review this document, keep in mind that the primary purpose of the planning criteria is to:
- Guide development of the resource management plans, particularly the alternatives and analysis of their effects.
- Ensure the analysis is tailored to the issues.
- Focus data collection (to avoid unnecessary).

Planning criteria must be made available for public review and comment prior to use (43 CFR 1610.4-2). Some planning criteria cannot be developed this early in the process. For example, specific criteria for designing or selecting the Preferred Alternative will be developed and shared later in the process (see Chapter 2).

Reviewing the proposed planning criteria is a critical point for your involvement, as these criteria will guide the rest of the Western Oregon Resource Management Plan Revisions process, particularly the effects analysis in the environmental impact statement. Getting your input about the planning criteria will help ensure that the analytical framework is sound now, not after the draft environmental impact statement is published.

When providing comments, it is most helpful if you:
refer to a chapter, subheading, or page.

Your comments specific to Chapters 2, 3, and 4 would be especially helpful.

Please mail your comments, by March 17, 2006, to the following address:
Bureau of Land Management (930.1)
Western Oregon Plan Revisions
P.O. Box 2965
Portland, Oregon 97208

Comments can also be sent by email to: orwopr@or.blm.gov.

Any suggestions that help keep the guidance concise and effective will be appreciated.

More information: http://www.blm.gov/or/plans/wopr

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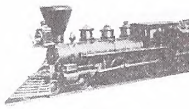

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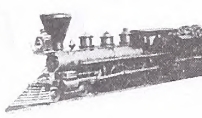
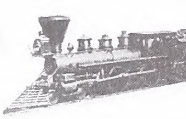


Chapter 1
Overview



Introduction

Statutory Basis for Management of BLM Lands

The Bureau of Land Management (BLM) manages public lands and resources of western Oregon according to the statutory provisions of two major laws: The Oregon & California Revested Lands Sustained Yield Management Act of 1937 (commonly called the O&C Act), and the Federal Land Policy and Management Act of 1976 (FLPMA). The BLM must comply with many other laws and regulations, but these two provide overall authority:

- The O&C Act requires that O&C lands be managed "... for permanent forest production, and the timber thereon shall be sold, cut, and removed in conformity with the principal [sic] of sustained yield for the purpose of providing a permanent source of timber supply, protecting watersheds, regulating stream flow, and contributing to the economic stability of local communities and industries, and providing recreational facilities ..." (43 U.S.C. §1181a). Approximately 2.1 million acres of lands in the planning area are O&C lands.

- The legal mandate for public domain lands is the Federal Land Policy and Management Act of 1976. These lands and resources are to be managed under the principles of multiple use and sustained yield. Approximately 400,000 acres of lands in the planning area are managed as public domain lands.

BLM Plan Revisions

The Federal Land Policy and Management Act requires BLM to develop and implement land use plans. The BLM uses a Resource Management Plan to meet this requirement.

The BLM has started a planning process to revise all of the resource management plans for western Oregon. These resource management plans are used to guide BLM's management decision on all lands administered by the agency. The current resource management plans were completed in 1995, shortly after the writing of the Northwest Forest Plan.

Geographic Areas in Planning and Analysis

A variety of different geographic areas is associated with resource management planning, decisions and analysis, and subsequent analysis of implementation actions:

Planning Area

The planning area is the geographic area within which the BLM will make decisions during a planning effort. A planning area boundary includes all lands regardless of jurisdiction. However, the BLM will only make decisions on lands that fall under BLM jurisdiction (including subsurface minerals). The planning area for the Western Oregon Resource Management Plan Revisions consists of the geographic areas of the Salem, Eugene, Coos Bay, Roseburg and Medford BLM Districts and the Klamath Falls Field Office of the Lakeview BLM District (see Figure 1).

Decision Area

The decision area is only the lands within a planning area for which the BLM has authority to make land use and management decisions. In general, the BLM has jurisdiction over all BLM-administered lands (surface and subsurface) and over subsurface minerals only in areas of split estate (areas where the BLM administers federal subsurface minerals, but the surface is owned by a non-federal entity or other federal agency).

Analysis Area

The analysis area is any lands, regardless of jurisdiction, for which the BLM compiles, analyzes, and interprets data and information related to planning for BLM-administered lands. Analyses extending beyond the planning area boundary allows management decisions to be made within the context of overall resource conditions and trends in the surrounding area, considering local, state, other federal and tribal plans. Examples of such information include the relative significance of BLM-managed lands for a certain resource (such as threatened or endangered species), or the anticipated impacts to resources (such as air quality and socio-economics) based on activities on BLM-administered lands. The analyses can be of any size; can vary according to resource; and can be located anywhere within, around, partially outside, or completely outside the planning or decision areas.

Fifth-field Watershed

The resource management plan/environmental impact statement will provide much information and analysis at the fifth-field watershed geographic area. Experience in implementing the 1995 western Oregon resource management plans demonstrated substantive benefits from planning and analyzing implementation actions at the fifth-field watershed geographic area, particularly in the analysis of cumulative effects.

Project-level or Site-specific Level

Project-level or site-specific information and analysis in the resource management plan is usually limited. Information and analysis in the resource management plan applicable to the project or site-specific level normally occurs in the form of broad, categorical or situational information and analysis, and programmatic direction.

Scales of Planning and Analysis

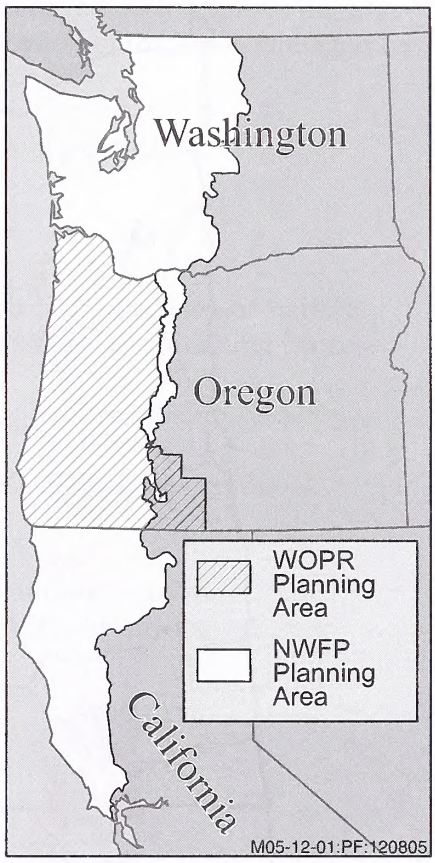
Planning and analysis may vary spatially (regional, fifth-field watershed, project or site-specific scale) and temporally (short term versus long term), providing a comprehensive basis for implementing resource management actions.

Planning and analysis at multiple scales may be necessary to resolve issues for a geographic area that differs from the planning area for the resource management plan. For example, an issue such as management of the northern spotted owl crosses BLM administrative boundaries and requires consideration of desired outcomes and management actions in a broader context than individual districts or the entire western Oregon planning area. Information presented at multiple geographic scales helps BLM to understand issues, analyze cumulative impacts, and tailor decisions to specific needs and circumstances.

In planning and analysis, it is often necessary to consider various temporal scales. Certain natural processes and implementation of management actions may occur over

a relatively short time period, whereas other natural processes and implementation of management actions occur over very long time periods. In cases where management action objectives may not be achieved for decades or even a century or more, interim benchmarks, rates of progress or trends should be identified where possible.

Figure 1. Planning Area.



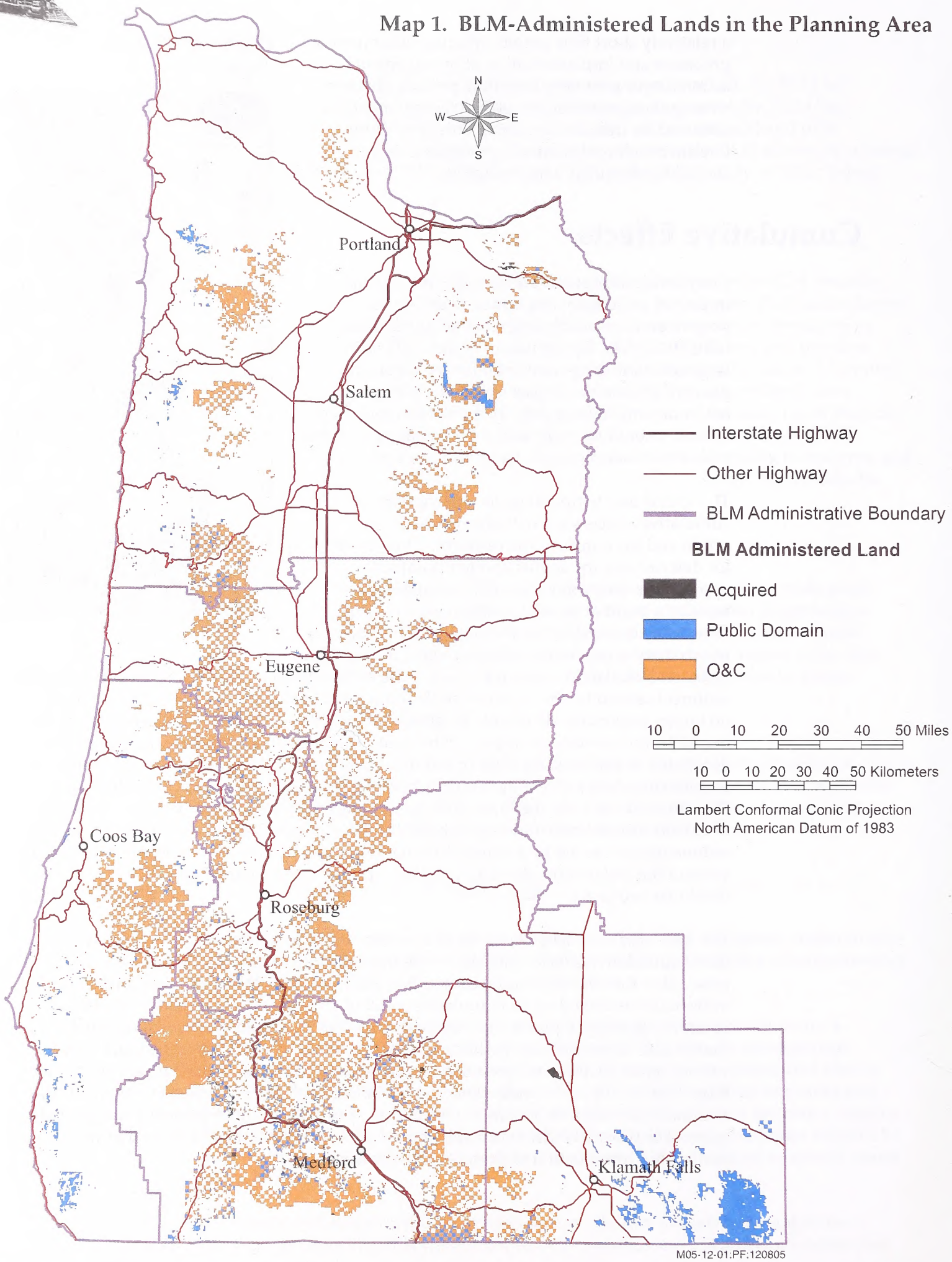
Cumulative Effects

Cumulative impacts result from the incremental impact of an action when added to other past, present and reasonably foreseeable future actions (40 CFR 1508.7). By the nature of the analysis in a large scale and long-term resource management plan environmental impact statement, almost all environmental effects described will be cumulative effects. Therefore, there will not be separate sections of discreet analysis labeled as cumulative effects.

The spatial and temporal scales appropriate for cumulative effects vary with the nature of the action and the nature of the resource. One screen for determining the spatial and temporal scale appropriate for cumulative effects analyses is to assess the point at which the effects are no longer reasonably detectable, in other words at that point in which there is essentially no incremental impact. For instance, installation of a culvert may cause sediment to enter a stream. If, however, the sediment caused by the culvert installation were to settle out or disperse so that it was no longer reasonably detectable in streams at the fifth-field watershed level, then there would be no incremental impact at that scale. Because there would be no reasonably detectable incremental increase in sediment at the fifth-field watershed scale, there would be zero cumulative effects at that scale resulting from multiple culvert installations. Therefore, in this case, the limit of the area appropriate for cumulative effects analysis of culvert installation would be at the fifth-field watershed scale or smaller. Similarly, if sedimentation caused by a culvert installation returns to background levels within two years of the installation, the temporal limit appropriate for cumulative effects analysis would be two years.

The RMP revisions will use the analytical assumptions identified in Chapter 3 when doing cumulative effects analysis, which must include a consideration of past and reasonably foreseeable future actions. For analysis in the RMP, the existing baseline information is considered a cumulative result of all past actions; therefore it is not necessary to analyze past actions individually. For BLM-managed lands, reasonably foreseeable future actions are those actions that would occur as described under the various alternatives. For Forest Service lands, reasonably foreseeable future actions are those that would occur under their current land use plans. For State of Oregon lands, reasonably foreseeable actions are those that would occur under present management plans. For private lands, reasonably foreseeable actions are those actions that would occur with continuation of present management.

Map 1. BLM-Administered Lands in the Planning Area



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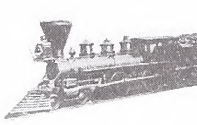


Lands Included in the Planning Area

The planning area includes public lands and resources managed by the Salem, Eugene, Roseburg, Medford, and Coos Bay BLM districts and a portion of the lands managed by the Lakeview District's Klamath Falls Field Office (see Map 1).

The planning area includes approximately 2,557,700 acres of public land.

BLM Planning Process and Schedule

Preparing a resource management plan involves nine interrelated actions or steps, as shown in Figure 2. The horizontal line shows the current step of the planning process.

The Analysis of the Management Situation, completed in October 2005, provides information that BLM managers will use to:

- Determine the BLM's ability to respond to identified issues and opportunities.
- Formulate reasonable alternatives.

This document is a draft of the planning criteria. Some planning steps may occur simultaneously, and a step may need to be repeated if significant new information becomes available.

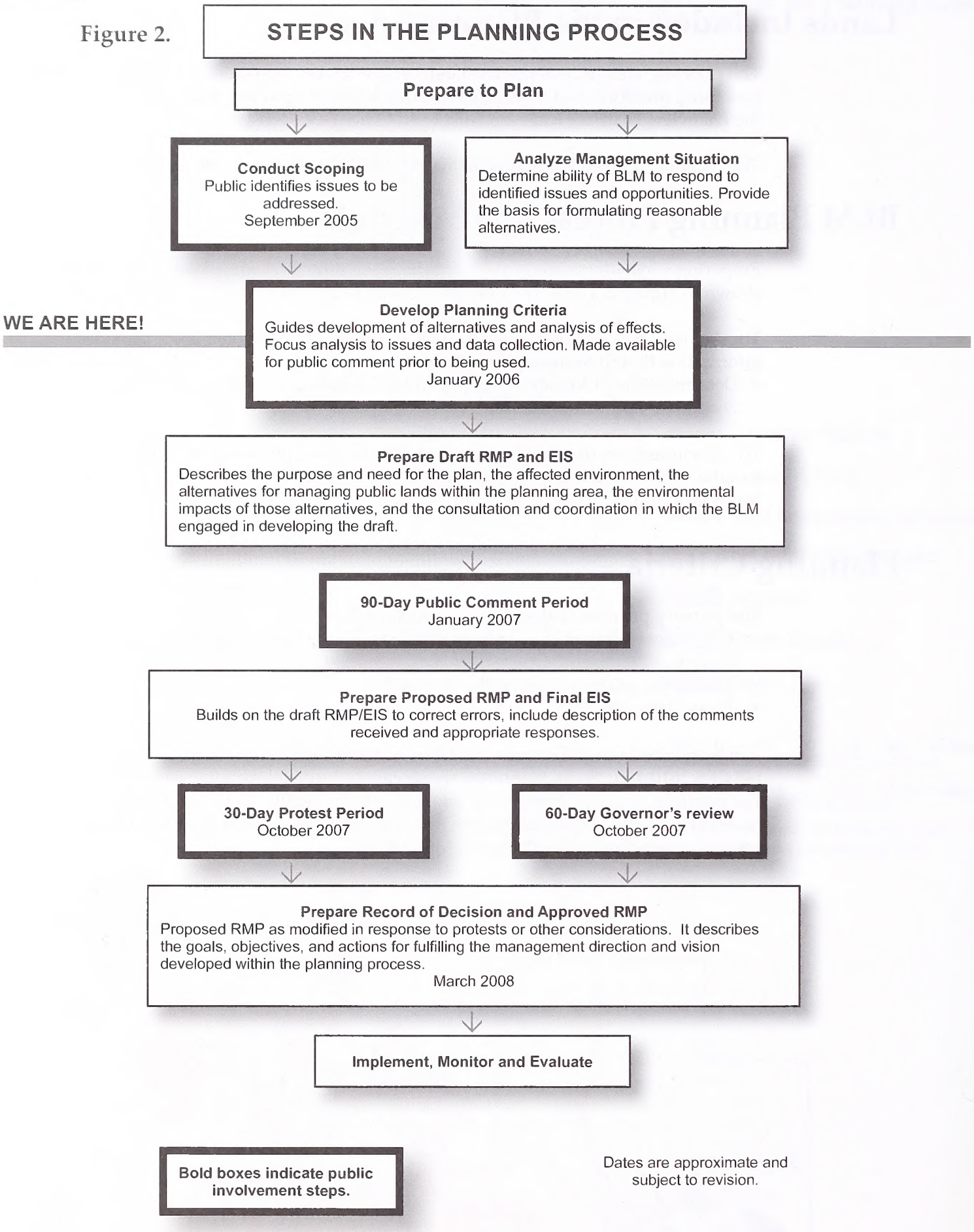
Planning Criteria

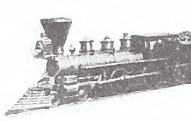
The primary purpose of the planning criteria is to:

- Guide development of the resource management plans, particularly alternatives and analysis.
- Ensure the analysis is tailored to the issues.
- Focus data collection.

Planning criteria must be made available for public review and comment prior to use (43 CFR 1610.4-2). Some planning criteria cannot be developed this early in the process. For example, specific criteria for designing or selecting the Preferred Alternative will be developed and shared later in the process. See Chapter 2 for additional information regarding selection of the Preferred Alternative.

Figure 2.


STEPS IN THE PLANNING PROCESS
Prepare to Plan
Conduct Scoping
Public identifies issues to be addressed.
September 2005
Analyze Management Situation
Determine ability of BLM to respond to identified issues and opportunities. Provide the basis for formulating reasonable alternatives.
WE ARE HERE!
Develop Planning Criteria
Guides development of alternatives and analysis of effects. Focus analysis to issues and data collection. Made available for public comment prior to being used.
January 2006
Prepare Draft RMP and EIS
Describes the purpose and need for the plan, the affected environment, the alternatives for managing public lands within the planning area, the environmental impacts of those alternatives, and the consultation and coordination in which the BLM engaged in developing the draft.
90-Day Public Comment Period
January 2007
Prepare Proposed RMP and Final EIS
Builds on the draft RMP/EIS to correct errors, include description of the comments received and appropriate responses.
30-Day Protest Period
October 2007
60-Day Governor's review
October 2007
Prepare Record of Decision and Approved RMP
Proposed RMP as modified in response to protests or other considerations. It describes the goals, objectives, and actions for fulfilling the management direction and vision developed within the planning process.
March 2008
Implement, Monitor and Evaluate
Bold boxes indicate public involvement steps.
Dates are approximate and subject to revision.



Vision and Goals

Vision

The vision statement for the Western Oregon Resource Management Plan Revisions (below in italics) is carried forward from the 1995 resource management plans with minor editing.

> *The Bureau of Land Management will manage the natural resources under its jurisdiction in western Oregon to contribute to the social well being of the human population and to help enhance and maintain the ecological health of the environment.*

Basic principles that support this vision include:

- Natural resources can be managed to provide for human use and a healthy environment.
- Resource management must be focused on ecological principles to reduce the need for single resource or single species management.
- The involvement of people working with natural processes is important for successful implementation.
- The ability to achieve this vision can be enhanced by cooperation with others and consideration of the ecological, social, and economic role that Bureau of Land Management administered-lands play in the context of adjacent lands.
- Monitoring, research, and adaptation will be used to make changes or adjustments necessary to achieve this vision.

Goals

Land use plan decisions establish goals and objectives for resource management (desired outcomes) and the measures needed to achieve these goals and objectives (management actions and allowable uses).

Goals are broad statements of desired outcomes that usually are not quantifiable. The Environmental Impact Statement will examine alternative ways to achieve the goals to the extent allowed under laws and land ownership patterns.

The goals established in the Northwest Forest Plan in 1995 are still valid and will remain as the goals for the plan revisions effort. An additional goal (see Goal 3 below) was added to explicitly address amenities. Background information is provided for each goal to enhance understanding of the broad goals.

Objectives identify specific desired outcomes for resources. Objectives are usually quantifiable and measurable. The objectives, management actions, and allowable uses for each alternative will vary to provide managers with distinct choices among potential management strategies for achieving the goals.

Goal 1 - Maintain healthy forest ecosystems with habitat that will support populations of native species and protection of riparian areas and water.

- **Manage the BLM lands within the landscape to contribute to conservation needs of special status species and ecosystems on which they depend**

The Endangered Species Act of 1973. The provisions of the Endangered Species Act, as amended, apply to plants and animals that have been listed as endangered or threatened, those proposed for listing, and designated and proposed critical habitat. The purposes of the Endangered Species Act (ESA) applicable to the BLM are:
(1) Provide a means to conserve the ecosystems upon which endangered species and threatened species depend;
(2) Provide a program for conservation of endangered species and threatened species.

The Endangered Species Act requires all federal departments and agencies to conserve endangered and threatened species while utilizing their authorities to achieve these purposes.

The Endangered Species Act also requires agencies to:

> *"...insure that any action...carried out by such agency is not likely to jeopardize the continued existence of any endangered species and threatened species or result in the destruction or adverse modification of habitat of such species."*

The BLM policy is broader than the Endangered Species Act. In addition to federally listed and proposed species, BLM policy addresses special status species that may be affected by BLM activities, for the following reasons:

- It is in the interest of the public and the affected special status species for BLM to undertake conservation actions for such species before listing is warranted, or before designation of critical habitat becomes necessary.
- It is also in the interest of the public and the affected special status species for BLM to undertake conservation actions that improve the status of such species to the point where their special status recognition is no longer warranted.
- Through these actions, the BLM will have greater flexibility in managing the public lands to accomplish native species conservation objectives, while fulfilling other mandates of the Federal Land and Policy Management Act.

The objective of the BLM Special Status Species Policy is to ensure BLM management actions are consistent with conservation needs of special status species and do not contribute to the need to list any Special Status Species under the provisions of the Endangered Species Act (BLM Manual 6840.02B).

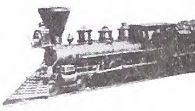
Special status species in Oregon include all federal and state listed species, candidates for federal and state listing, and all species designated by the Oregon/Washington State Director as a sensitive or assessment species.

- **Provide clean waters that support viable fish and wildlife populations, domestic water use, safe drinking water, functioning riparian areas, and recreation use.**

The objective of the Clean Water Act "is to restore and maintain the chemical, physical, and biological integrity of the Nation's waters."

The Federal Land Policy and Management Act (FLPMA) requires BLM planning to comply with state and federal water pollution control laws. The Clean Water Act requires that all Resource Management Plans be consistent with state water quality standards.

The Clean Water Act also allows governors to specify BLM as a designated management agency. BLM thus becomes responsible for implementing state developed water quality management plans on public lands it administers. Beneficial uses of clean water commonly designated on BLM-managed streams include fish and aquatic species, domestic water supply, fishing, and recreation.



The Endangered Species Act recognized the link between water resources and species in its statement that "federal agencies shall cooperate with State and local agencies to resolve water resource issues in concert with conservation of endangered species."

The Safe Drinking Water Act was originally passed by Congress in 1974 to protect public health by regulating the nation's public drinking water supply. The law was amended in 1986 and 1996 and requires many actions to protect drinking water and its sources: rivers, lakes, reservoirs, springs, and ground water wells.

Under the Safe Drinking Water Act, the Environmental Protection Agency sets standards for drinking water quality and oversees the states, localities, and water suppliers that implement those standards.

Every state must conduct an assessment of its sources of drinking water (rivers, lakes, reservoirs, springs, and ground water wells) to identify significant potential sources of contamination and to determine how susceptible the sources are to these threats.

- **Maintain the capacity of soils to function for sustained timber yield.**

  The O&C Act requires that timber lands be managed for permanent forest production. The BLM will maintain the capacity of soils to function for sustained biological productivity, environmental quality, and to promote plant and animal health.

- **Prevent introduction of invasive species and provide for their control to minimize impacts to economic, ecological, and human health**

  Invasive plant management is an inherent part of maintaining healthy forest ecosystems associated with BLM-managed lands in western Oregon. Invasive plants have been identified as a significant threat to habitat and species diversity.

  Several federal acts and statutes support the Invasive Species Executive Order 13112 of February 3, 1999, which addresses the need "to prevent the introduction of invasive species and provide for their control and to minimize the economic, ecological, and human health impacts that invasive species cause."

- **Restore fire-resilient stands and protect communities at risk from uncharacteristic wildfire.**

  President Bush signed the Healthy Forests Restoration Act in December 2003. The Healthy Forests Restoration Act (sometimes referenced as the HFRA) contains a variety of provisions to reduce hazardous fuels on National Forest System lands and Bureau of Land Management lands. The goal of the Act is to protect communities, watersheds, and at-risk forest and range lands from catastrophic wildfire.

  The Act directs the Forest Service and Bureau of Land Management to maximize retention of larger trees in areas other than old-growth stands, consistent with the objective of restoring fire-resilient stands and protecting 'at-risk' communities and Federal lands.

- **Identify, designate, and protect areas of critical environmental concern.**

  The Federal Land and Policy Management Act requires BLM to prepare and maintain, on a continuing basis, an inventory of all public lands and their resources and other values...giving priority to areas of critical environmental concern. It further states that in the development and revision of land use plans, the Secretary shall give

priority to the designation and protection of areas of critical environmental concern. (Sec. 201 [43 U.S.C. 1711] and Sec. 202 [43 U.S.C.1712].)

- **Protect public lands and their resources from mineral entry uses.**

  Section 204 of FLPMA authorizes the Secretary of the Interior to withdraw public lands from operation of public land and mineral laws to avoid irreparable damage that may be caused by nondiscretionary activities.

Goal 2 - Provide a sustainable supply of timber and other forest products that will help maintain the stability of local and regional economies, and contribute valuable resources to the national economy on a predictable and long-term basis.

- **Maintain permanent forest production in conformity with the principles of sustained yield.**

  The O&C Act of 1937 provides that the revested Oregon and California Railroad and reconveyed Coos Bay Wagon Road Act grant lands under the jurisdiction of the Department of the Interior that are classified as timberlands shall be:

  > *"managed... for permanent forest production and the timber thereon shall be sold, cut, and removed in conformity with the principal [sic] of sustained yield for the purpose of providing a permanent source of timber supply, protecting watersheds, regulating stream flow, and contributing to the economic stability of local communities and industries, and providing recreational facilities."*

  The O&C lands were seen by Congress as a resource for communities and as an opportunity to contribute to the long-range stability of communities by preventing over-cutting of the land and providing for reforestation of cut-over lands (USDI 1945).

- **Annually declare and sell timber in an amount equal to the sustained yield capacity of the forested lands.**

  The O&C Act further required establishment of an annual productive capacity and the requirement to sell that amount annually:

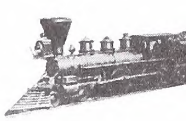
  > *"Provided, that timber from said lands in an amount not less than one-half billion feet board measure, or nor not less than the annual sustained yield capacity (emphasis added) when the same has been determined and declared, shall be sold annually (emphasis added), or so much thereof as can be sold at reasonable prices on a normal market."*

- **Provide for multiple uses on public domain lands.**

  The Federal Land Policy and Management Act requires public lands to:

  > *"... be managed in a manner that will protect the quality of scientific, scenic, historical, ecological, environmental, air and atmospheric, water resource, and archeological values; that, where appropriate, will preserve and protect certain public lands in their natural condition; that will provide food and habitat for fish and wildlife and domestic animals; and that will provide for outdoor recreation and human occupancy and use."*

  The Act further states that public lands will "... be managed in a manner which recognizes the Nation's need for domestic sources of minerals, food, timber, and fiber from the public lands ...."



The Act calls for the various resource values to be managed so that they are utilized in the combination that will best meet the present and future needs of the American people.

The Federal Lands and Policy Management Act acknowledged the unique purpose of the O&C lands, stating that in the event of conflict with or inconsistency between FLPMA and the O&C Act "...insofar as they [the Act] relate to management of timber resources, and disposition of revenues from lands and resources, the latter Acts shall prevail."

In this case, the "latter Acts" refers to the O&C Act.

- **Acquire adequate legal access to public lands for forest management activities and the removal of federal timber.**

  The BLM timber sale policy requires that federal timber offered for sale by competitive bidding have guaranteed legal access for all prospective purchasers.

  Section 502 of the Federal Land Policy and Management Act authorizes the Secretary of the Interior to provide for acquisition, construction, and maintenance of roads that will permit maximum economy in harvesting timber from public lands and at the same time meet the requirements for protection, development, and management of such lands for utilization of other resources thereof.

Goal 3 - Provide amenities that enhance communities as places to live and work.

- **Provide cultural resources for the benefit of present and future generations.**

  The Federal Land Policy and Management Act requires public lands to be managed for historical and archeological values.

  The National Historic Preservation Act (as amended through 1992) requires BLM to administer federally owned, administered or controlled prehistoric and historic resources in a spirit of stewardship for the inspiration and benefit of present and future generations. These benefits include cultural, educational, esthetic, inspirational, economic, and energy.

- **Provide a broad spectrum of recreation opportunities.**

  The Federal Land Policy and Management Act requires public lands to be managed for scenic values and to provide for outdoor recreation.

  The BLM policy calls for a broad spectrum of resource-dependent recreation opportunities to meet the needs and demands of public land visitors, while ensuring continued availability of public lands and related waters for a diversity of resource-dependent outdoor-recreation opportunities.

  Additionally, the O&C Act states that one expected benefit of managing timberlands for permanent forest production, according to sustained forestry principles, is the provision of recreation facilities.

- **Make public lands available for special uses and needed rights-of-way.**

  The Federal Land Policy and Management Act provides for conservation and management of the public lands and authorizes the Secretary of the Interior to

provide for the use, occupancy, and development of the public lands through permits, easements, and rights-of-way.

- **Protect public health and welfare by mitigating the impacts of air pollution emissions from wildland and prescribed fire on air quality and visibility.**

  The underlying purpose of the Clean Air Act is to establish minimum national standards for air quality. The Clean Air Act most commonly affects planning and implementation of the Bureau of Land Management's wildland and prescribed fire program.

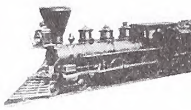
  The Environmental Protection Agency's interim guidance on Wildland and Prescribed Fire (1998) integrates two public policy goals:

  (1) Allow fire to function, as nearly as possible, in its natural role in maintaining healthy wildland ecosystems, and

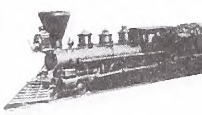
  (2) Protect public health and welfare by mitigating the impacts of air pollutant emissions on air quality and visibility.

Reference

USDI, General Land Office, 1945. Forever Timber: Perpetual Sustained Yield Forestry on the Revested Oregon and California Railroad Grant Lands and the Reconveyed Coos Bay Wagon Road Grant Lands in Western Oregon.



Chapter 2 Guidance for Formulating Alternatives



This chapter is divided into two sections: Background on Formulating Alternatives, and Alternative Development.

Background on Formulating Alternatives

Management Guidance in O&C Act and the Federal Land Policy and Management Act (FLPMA)

The Oregon and California Railroad and Coos Bay Wagon Road Grant Lands Act (O&C Act) (43 U.S.C. §1181a, et seq.) provides the legal authority for the Secretary of Interior to manage O&C lands. The O&C Act requires that the O&C lands "classified as timberlands ... shall be managed ... for permanent forest production, and the timber thereon shall be sold, cut, and removed in conformity with the principal [sic] of sustained yield for the purpose of providing a permanent source of timber supply, protecting watersheds, regulating stream flow, and contributing to the economic stability of local communities and industries, and providing recreational facilities." (43 U.S.C. §1181a)

The Federal Land Policy and Management Act provides the legal authority for the Secretary of Interior to manage public domain lands. In part, FLPMA requires that "...the public lands be managed in a manner that will protect the quality of scientific, scenic, historical, ecological, environmental , air and atmospheric, water resource, and archeological values; that, where appropriate, will preserve and protect certain public lands in their natural condition; that will provide food and habitat for fish and wildlife and domestic animals; and that will provide for outdoor recreation and human occupancy and use; ..." And in addition that, "... the public lands be managed in a manner which recognizes the Nation's need domestic sources of minerals, food, timber, and fiber from the public lands . . ." (43 U.S.C. 1701 §102a)

Section 701(b) of the Federal Land Policy Management Act states "Notwithstanding any provision of this Act, in the event of conflict with or inconsistency between this Act and [the O&C Act] ..., insofar as they relate to management of timber resources, and disposition of revenues from lands and resources, the latter Acts shall prevail." In this case, the "latter Acts" refers to the O&C Act.

In addition to the O&C Act and Federal Land Policy Management Act, the management of O&C lands and public domain lands in western Oregon are governed by a variety of statutes, including the Endangered Species Act (ESA), and the Clean Water Act. In meeting the various requirements for managing these lands, the Secretary of the Interior has discretion under the O&C Act to determine how to manage the forest to provide for permanent forest production on a sustained yield basis. The O&C Act does state that "the timber thereon shall be sold, cut, and removed in conformity with the principal [sic] of sustained yield" but it does not specify the harvest methods, rotation, or silviculture regimes under which these forests will be managed.

Interpretation of the O&C Act

Implementation of the O&C Act of 1937

In 1937, Congress passed the Oregon and California Revested Lands Sustained Yield Management Act (commonly called the O&C Act), Public Law 75-405, putting the lands under the jurisdiction of the Department of the Interior. The O&C Act pertains only

to revested O&C lands and Coos Bay Wagon Road lands. The Act embraced the new principles of sustained yield, requiring that harvested areas be reforested and a sustained annual harvest be declared. One goal of the Act was to provide a future source and sustained flow of timber that would contribute to local economic stability.

Court Cases Pertaining to the O&C Act

There are three major court cases that interpret the O&C Act: two in the Ninth Circuit Court, and one in the Western Washington District Court. These cases provide interpretation of the O&C Act. A summary of each of the three cases is provided below:

- Headwaters v. BLM 1990 - In an opinion by the Ninth Circuit Court of Appeals in September 1990, 914F.2d 1174, the court ruled that the O&C Act was a dominant use act and that such interpretation was consistent with the Act.

  "... the provisions of 43 USC 1181a make it clear that the primary use of the [O&C Act] lands is for timber production to be managed in conformity with the provision of sustained yield."

  "There is no indication that Congress intended "forest" to mean anything beyond an aggregation of timber resources."

  "It is entirely consistent with these goals to conclude that the O&C Act envisions timber production as a dominant use and that Congress intended to use "forest production" and "timber production" synonymously. Nowhere does the legislative history suggest that wildlife habitat conservation or conservation of old growth forest is a goal on a par with timber production, or indeed that it is a goal of the O&C Act at all. The BLM did not err in construing the O&C Act as establishing timber production as the dominant use."

- Portland Audubon Society v. Lujan 1993

  "We find that the plain language of the Act (O&C Act) supports the district court's conclusion that the Act has not deprived the BLM of all discretion with regard to either the volume requirements of the Act or management of the lands entrusted to its care."

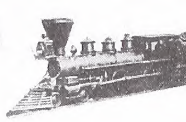
  "... there does not appear to be a clear and unavoidable conflict between statutory directives [O&C Act and NEPA], we cannot allow the Secretary to utilize an excessively narrow construction of its existing statutory authority to avoid compliance (with NEPA)."

- Seattle Audubon Society v. Lyons 1994 (Judge Dwyer) – This is not a Ninth Circuit Court decision and only controls decisions in the Western District of Washington. Outside the Western District of Washington, the decision is only effective where it is persuasive.

  Note: In the following text, O&CLA refers to the O&C Lands Act, ROD refers to Record of Decision, and LSOG refers to Late-Successional Old Growth.

  Talking about Portland Audubon Society v. Lujan *"The court further held that O&CLA does not allow the BLM to avoid its conservation duties under NEPA or ESA ..."*

  "An agency's construction of the laws it administers is accorded considerable weight. The management decision made here [Northwest Forest Plan] in regard to the O&CLA lands was a lawful exercise of the Secretary's discretion. If this ruling were to be reversed on appeal, the ROD would have to be reconsidered because of the loss of important LSOG and riparian reserves."



BLM's Application of the O&C Act

The following discussion supersedes any previous BLM interpretations of the O&C Act.

Based on interpreting the language of the O&C Act, its legislative history, and the court cases cited above, it is the BLM's position that management of timber (including cut and removal) is the dominant use of the O&C and Coos Bay Wagon Road lands in western Oregon. That dominant use must be implemented in full compliance with not only the O&C Act, but also a number of subsequent laws that direct how BLM accomplishes that goal.

National policies, such as the Special Status Species Policy BLM Manual 6840, will apply to the extent they are consistent with the O&C Act. The prescription, timing, and methods of timber harvest can be adjusted, but lands cannot be removed from the harvest land base solely to protect values not required by a law.

Areas of Critical Environmental Concern will be managed to protect their relevant and important features to the extent this does not conflict with the O&C Act. Lands cannot be removed from the harvest land base solely to protect relevant and important features. Timber management in this designation is an allowable use, but the cutting intensity, frequency, prescription, and method may be adjusted to protect relevant and important features. Such adjustment may result in lower timber outputs.

The O&C lands cannot be designated a Wilderness Study Area under the current laws and regulations. The prescribed 15-year time period to identify areas with Wilderness characteristics, provided for in the Federal Land Policy and Management Act of 1976, is expired.

Visual resource management must be consistent with the O&C Act, unless the O&C Act is superseded by another act (such as a Wild and Scenic River designation) that did not specifically exempt O&C lands. Timber management in this designation is an allowable use, but the cutting intensity, frequency, prescription, and method may be adjusted to protect visual features. Such adjustment may result in lower timber outputs.

The management of developed recreation facilities on O&C lands is consistent with, and in fact is specifically mentioned, in the O&C Act. Management of recreation sites (other than facilities) and areas such as Special Recreation Management Areas (SRMAs) must be consistent with the O&C Act. These lands cannot be removed from the timber base solely to maintain recreation values. Timber management in this designation is an allowable use, but the cutting intensity, frequency, prescription, and method may be adjusted to maintain the recreation experience and visitor safety in these areas. Such adjustment may result in lower timber outputs.

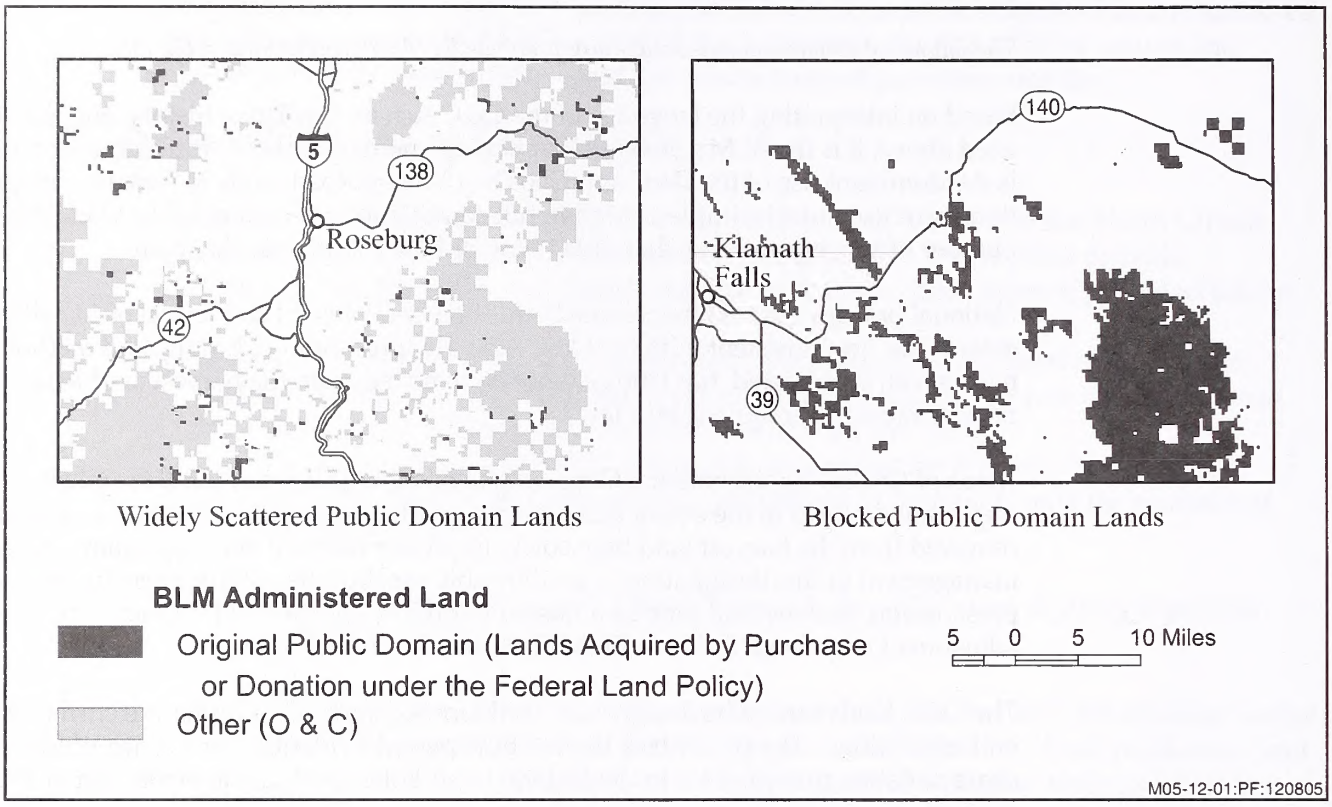
Management Direction for Public Domain Lands

The Federal Land Policy and Management Act requires public lands to "... be managed in a manner that will protect the quality of scientific, scenic, historical, ecological, environmental, air and atmospheric, water resource, and archeological values; that, where appropriate, will preserve and protect certain public lands in their natural condition; that will provide food and habitat for fish and wildlife and domestic animals; and that will provide for outdoor recreation and human occupancy and use."

The Act further states that public lands will "... be managed in a manner which recognizes the Nation's need for domestic sources of minerals, food, timber, and fiber from the public lands ..."

The Act provides additional guidance to BLM in deciding among the variety of potential uses. It advises that public domain lands and their various resource values be managed

Figure 3. Widely Scattered Public Domain Lands and Blocked Public Domain Lands.



"... so that they are utilized in the combination that will best meet the present and future needs of the American people ...."

Of the 2,557,700 acres of BLM-managed lands in the planning area, approximately 394,600 are public domain lands. About half of those public domain acres are widely scattered and intermingled with O&C lands (Figure 3). Although FLPMA requires that public domain lands be managed for a multitude of values, it does not require that every parcel be managed for every value. Given their small size and scattered nature, these public domain parcels will be managed primarily for sustained yield of timber resources along with the surrounding O&C lands consistent with the goals and objectives of the land use plan. There will not be a separate set of objectives and management actions for these scattered public domain lands.

Several large, contiguous tracts in the Klamath Falls Resource Area, the Coos Bay District, and the Salem District account for over half of the public domain acres in the planning area. These areas will be managed for a variety of values, which may include sustained yield of timber resources. Some objectives and management actions for these areas may differ from those of O&C lands, particularly in the non-forested lands east of the Cascade Mountains.

Purpose and Need of the Proposed Action

The BLM is proposing the Western Oregon Resource Plan Revisions to respond to the need to achieve the O&C Act's requirement of permanent forest production, as interpreted by the 9th Circuit Court of Appeals, on the O&C lands while complying with other applicable laws such as the Endangered Species Act, Clean Water Act, FLPMA, etc.

The purposes of the plan revisions are to:

- Create quality habitats, especially for endangered species.
- Improve conditions in water quality limited streams.
- Produce a sustainable amount of timber.
- Contribute to community economic resiliency.
- Minimize the cost of implementation, both in effort and dollars.
- Provide economic return to the U.S. Treasury and western Oregon counties.

Alternative Development

How Alternatives Are Identified

An alternative is a combination of proposed land use allocations, activities, resource uses, and management practices designed to meet the stated purpose and need for the plan revisions (see above).

The National Environmental Policy Act requires an agency to rigorously explore and objectively evaluate all reasonable alternatives. A reasonable alternative is one that:

- Meets the purpose and need.
- Is feasible and practicable.
- Is not exorbitant.
- Is not a variation of an alternative analyzed in detail.

Each alternative represents a separate set of objectives, land use allocations, and management actions that address and resolve the purpose and need in a different way. In developing the array of alternatives for the Western Oregon Plan Revisions, four broad strategies were identified. These strategies are based on BLM's experience implementing the current plans; results of the Conference on Science and the Northwest Forest Plan: Knowledge Gained over a Decade; and information received during public scoping. Developing at least one alternative for each strategy will meet the Council of Environmental requirements for a reasonable range of alternatives. The four strategies are described below.

Four Strategies for Developing Alternatives for the Western Oregon Plan Revisions

- *Strategy 1* - Maintain land use allocations in their present configuration with relatively minor changes in management direction. This would be the required No Action Alternative.
- *Strategy 2* - Maintain land use allocations in their present configuration with the exception of riparian reserves. Examine an alternative aquatic strategy. Revise standards and guidelines for other land use allocations based on lessons learned. (Northwest Forest Plan with some changes).
- *Strategy 3* - A new management strategy with different land use allocations and different management direction.
- *Strategy 4* - A new management strategy that minimizes the partition of land into land use allocations. Situational management direction based on desired conditions at broad landscape scales.

These four strategies were used to develop possible action alternatives for development and detailed analysis, as described in following text.

Objectives and management direction will be written in specific, measurable, and trackable terms as appropriate for each alternative. Additional variation within an alternative will be evaluated using sub-alternatives or sensitivity analysis.

Sub-alternatives analyze the effects of adding or removing an element of an alternative to analyze the impacts of that action without developing an entirely new alternative. An example would be to eliminate all regeneration harvest from one or more alternatives.

Sensitivity analysis varies a constant element of an alternative and identifies opportunities and costs associated with each degree of application. An example would be to vary the width of riparian areas within one or more alternatives.

Consideration of Issues in Alternative Development

As alternatives are developed, the following preliminary issues will be addressed:

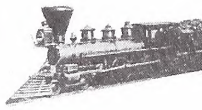
- *Vegetation* - How should BLM provide a sustainable supply of wood and other forest products as mandated by the O&C Lands Act while meeting applicable laws and regulations?
- *Habitat for Special Status Species* - How can BLM-managed lands contribute to conservation of species consistent with the Endangered Species Act?
- *Watershed Management and Water Quality* – How can BLM-managed lands contribute to meeting the goals of the Clean Water Act and the Safe Drinking Water Act?
- *Wildland Fire and Fuels* - How should BLM manage public lands to reduce the risk of wildfires and integrate fire back into the ecosystem?

These four preliminary issues were validated through public scoping.

Guidance for Development of All Action Alternatives

The following actions will be included in all action alternatives:

- Reduce or eliminate process and mid-level analysis requirements (such as upper level reviews, watershed analysis, and late-successional reserve assessments).
- Clearly define adaptive management processes.
- Working closely with the Oregon State Department of Environmental Quality, satisfy state requirements of Water Quality Management Plans at the resource management plan level.
- Satisfy the Clean Air Act requirements.
- Working closely with Federal regulatory agencies, provide sufficient detail in the analysis to reduce the need for project-level Endangered Species Act consultation and provide for recovery or conservation of species listed under the Endangered Species Act.
- Provide a framework to facilitate subsequent cumulative effects and reduce the need for project-level NEPA analysis.
- Review existing Special Recreation Management Areas (SRMAs) and Extensive Recreation Management Areas (ERMAs) and do the following:
  - Adjust boundaries of SRMAs to incorporate acquired lands, consolidate areas, consider resource values, etc.
  - Revise management direction where need is identified.
  - Eliminate SRMA designations for areas that no longer meet the criteria for inclusion, or are inconsistent with goals and objectives of the alternatives.
  - Add additional potential recreation sites, trails, and other facilities to the list of possible SRMAs for future development.
  - Eliminate those potential recreation sites, trails, and other facilities that are no longer needed from the list of possible SRMAs for future development.
- Review nominations for new Areas of Critical Environmental Concern, as well as existing Areas of Critical Environmental Concern, and do the following:
  - Determine if they meet the Relevance and Importance criteria.
  - For those on O&C lands that meet Relevance and Importance criteria, determine if designation would be a conflict with the O&C Act.



  - Eliminate from further consideration those areas that do not meet criteria for designation as Areas of Critical Environmental Concern.
  - Determine if management of the remaining nominations can be accommodated within the alternatives.
  - In development of alternatives, include those nominations that meet criteria for designation as Areas of Critical Environmental Concern.

- Designate areas in Visual Resource Management classifications consistent with alternatives, and incorporate new national policy on Wilderness Study Areas.
- Designate areas as "open," "limited," or "closed" to off-highway vehicle use.
- Designate special cultural resources that may affect the location, timing, development, or use of other resources.
- Designate areas that are available and have the capacity for planned, sustained-yield timber harvest or special forest product harvest.
- Designate lands that are available or not available for livestock grazing.
- Designate lands for retention or disposal.
- Designate lands as "open" or "closed" to the several forms of mineral entry location, leasing, or sale as is appropriate to the type of commodity and land status.

Possible Action Alternatives for Development and Detailed Analysis

The preliminary alternatives listed below include proposals that were identified during public scoping. These alternatives may be altered or refined based on public comments, or refinements made during development of objectives and management action/direction.

Each possible action alternative described below is based on one of the four strategies for developing alternatives discussed earlier in this chapter.

<u>No Action Alternative (Represents Strategy 1)</u>

- The No Action Alternative will be analyzed as written in the existing resource management plans.

<u>Revised Northwest Forest Plan with Particular Focus on a Different Riparian Reserve (Based on Strategy 2)</u>

- Retain current land use allocations except riparian reserves.
- Retain Aquatic Conservation Strategy Objectives; however, develop different strategies to attain the objectives.
- Incorporate sources for large wood contribution to streams in the riparian reserves.
- Remove terrestrial objectives from riparian reserves.
- Emphasize density management in reserves.
- Remove minimum age requirements for applying harvest treatments.
- Allow for density management of stands in reserves past 80 years of age.
- Re-examine need for connectivity/diversity blocks.
- Re-examine need for or location of key watersheds.
- Re-examine need for adaptive management areas.
- Acknowledge that natural disturbance may set stand age to 0.

Sub-alternatives

- Thin only. No regeneration harvest.
- Allow regeneration harvest of older stand *only* when thinning of younger stand will no longer support the Allowable Sale Quantity.

Sensitivity Analysis

- Reserve stands at ages greater than 80, 120, and 200 years of age.
- Test various riparian reserve widths.

Traditional Static Reserve Land Allocation Management with Land Use Allocations Based on Meeting Legal Requirements (Based on Strategy 3)

- Establish land use allocations *only* to meet legal requirements.
- Establish land use allocation based on maintaining sufficient suitable habitat within critical habitat for listed species.
- Establish reserves to avoid jeopardy and meet Clean Water Act, which for State and private lands is the Oregon Forest Practices Act.
- Practice traditional intensive forest management to produce high timber yields in lands not removed from harvest land base.
- Acknowledge that natural disturbance may set stand age to 0.

Sub-alternatives

- Thin only. No regeneration harvest.
- Allow regeneration harvest of older stand *only* when thinning of younger stand will no longer support the Allowable Sale Quantity.

Sensitivity Analysis

- Reserve stands at ages greater than 80, 120, and 200 years of age.
- Test various riparian reserve widths.

Minimize Land Use Allocations and Manage Under Extended Rotation (Based on Strategy 4)

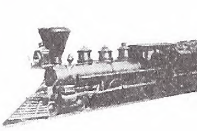
- Minimize partitioning by land use allocations (except for Congressional designations or special areas established for threatened or endangered species).
- Manage entire land base for timber production (with the above exceptions) under a long rotation (such as 300 years).
- Manage young stands for timber production in the near term, including intermediate harvest to improve stand structure, or regeneration harvest in younger stands.
- Provide a density management harvest to provide for complex stand structure.
- Maintain habitat until the desired age class distribution is achieved.
- Conduct active management across all lands (with above exceptions).
- Have one rule set for the entire land base.

Sensitivity Analysis

- Test impact of various rotation ages on desired conditions.

Situational Management Under Constant Change Theory (Based on Strategy 4)

- Minimize partitioning by land use allocations (except for Congressional designations or special areas established for threatened or endangered species).
- Vary management direction by watershed or an aggregation of similar watersheds.
- Base the management direction on percentage of BLM ownership, importance of streams, presence of critical habitat, and special status species "hot spots," etc.
- Incorporate structural-based management concepts.
- Use situational management, which would vary with changing circumstances.
- Overlay landscape with wildland urban interface in a manner similar to key watersheds to help focus management in those areas.



- Avoid management that would cause catastrophic disturbance in the O&C checkerboard.

Sensitivity Analysis

- Test various combinations of stand structure on achieving desired conditions.

Budget Considerations

Over the last few years, BLM's labor costs have been increasing while funding has essentially been flat. By 2010, a 30 percent decline is expected in the purchasing power of the budget due to inflationary effects combined with flat or declining budgets. The alternatives will have some costs associated with them that will vary, depending on three factors:

1. *Complexity of the NEPA and consultation required to implement the alternative.* For example, an alternative that clearly defines and constrains management actions over a limited landscape would be less complex to analyze and plan than alternatives that allow for a wide variety of management actions across the general landscape.

2. *Complexity of preparing the projects and the level of expertise required of employees preparing the projects.* For example, because they tend to cover larger areas of land than regeneration harvests, thinning sales require more time and personnel to prepare than regeneration harvest. However, the cruising skill level and local knowledge required in thinning sales are less than those needed to cruise old-growth timber. In addition, thinning requires only a minimum investment in forest development costs or nursery maintenance compared to the site preparation, seedling costs, and protection costs of reforestation following regeneration harvest.

3. *Controversy with management actions associated with the alternatives.* A regime of thinning in upland areas is less likely to generate challenges in the form of protests and appeals or litigation compared to regeneration harvest or implementing projects in riparian areas. Therefore, thinning requires less time to conduct NEPA analysis, complete consultation under the Endangered Species Act, and respond to protests or litigation.

Alternatives will not be constrained by anticipated budget levels. Comparison between alternatives will be accomplished by comparison to current budget levels.

The analysis in the Environmental Impact Statement will consider the following factors:

- Cost in effort and/or dollars required to implement the plan.
- Revenue generated to the U.S. Treasury and counties.

Research

Ongoing research projects will be protected, to the extent possible, under all alternatives. When existing research actions are not consistent with alternative prescriptions or land use allocations, the projects will be analyzed for continued relevancy, and if found necessary, temporary allocations or deferrals may be allocated to allow for research completion. New research proposals considered necessary to test planning and modeling assumptions and provide data for plan monitoring will be identified during alternative development and creation of the monitoring plan. Research proposals not directly related to plan monitoring and testing will be analyzed for conformity with the O&C Act, as implemented in the land use allocations and prescriptions for each alternative.

Existing Decisions

Two categories of resource decisions will be carried forward into the revised resource management plans:

1. *Decisions that are valid for continued implementation and are supported by an Environmental Impact Statement.* These will be restated or summarized to incorporate them into the resource management plan without additional analysis. Some minor revisions may be made for clarity or applicability to the resource management plan revisions.

   These decisions will be common to all alternatives and include the following:
   - Cascade-Siskiyou National Monument Resource Management Plan.
   - Management plans for Congressionally designated areas such as Wilderness Areas, Wilderness Study Areas, and Wild and Scenic Rivers.
   - West Eugene Wetlands (Eugene District).
   - North Bank Habitat Management Area (Roseburg District).
   - Wood River Wetland (Klamath Falls Field Office).
   - North Spit Management Area (Coos Bay District).
   - Herd Management Area Plan (Klamath Falls Field Office)
   - Draft Vegetation Treatments Using Herbicides on Bureau of Land Management Lands in 17 Western States Programmatic Environmental Impact Statement.
   - Management of Port-Orford-Cedar in Southwest Oregon Supplemental Environmental Impact Statement.
   - Wind Energy Development Programmatic Environmental Impact Statement.
   - Seed Orchard Environmental Impact Statements

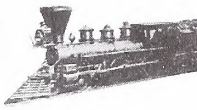
   Although management objectives and actions are contained in previous decisions, the lands covered by these plans will be included in the analysis of environmental effects as appropriate.

2. *Decisions that are valid for continued implementation, but are not addressed in an Environmental Impact Statement or fully supported by NEPA analysis.* These decisions may be addressed in the resource management plan and associated environmental impact statement. This type of decision will also be common to all alternatives, but the analysis would be incorporated into the environmental consequences section of the Environmental Impact Statement.

   Examples of these types of decisions include:
   - National Sage Grouse Habitat Conservation Strategy
   - Healthy Forest Initiative
   - Standards for Rangeland Health and Guidelines for Livestock Grazing Management for Public Lands in Oregon and Washington

Criteria for Selecting Preferred Alternative and Environmentally Preferred Alternative

Generally, the preferred alternative will be the one that accomplishes both of the objectives of the Purpose and Need to the greatest extent in the long and short term, while meeting required environmental standards. There will be one preferred alternative identified for all six BLM offices. All six RMP Records of Decision will be consistent in the selection of the preferred alternative for the RMPs. Specific criteria for selection will be developed during the process.



The Environmentally Preferred Alternative is the alternative or alternatives that will promote the national environmental policy as expressed in NEPA's Section 101. Ordinarily, this means the alternative that causes the least damage to the biological and physical environment; it also means the alternative that best protects, preserves, and enhances historic, cultural, and natural resources.

Science Framework for the Plan Revisions

The BLM is implementing a science framework intended to facilitate a sustained dialogue among scientists and managers throughout the resource management plan revisions process.

Objectives for Having Science Framework

Involvement of scientists in the resource management plan revisions process is intended to:

- Provide BLM with an understanding of current scientific knowledge.
- Help ensure that the analytical process is founded on credible assumptions and also uses appropriate methodologies.
- Provide specialized sources of expertise not otherwise available.
- Provide innovative scientific perspectives concerning management strategies to meet RMP objectives.
- Help ensure that relevant science is considered, reasonably interpreted, and accurately presented; and that uncertainties and risks are acknowledged and documented.
- Share relevant information and knowledge with interested citizens, interest groups, cooperators, and media.

Strategy for Incorporating Science Framework in Plan Revisions

The science framework is multi-faceted to create alternative forms of interaction with scientists, provide a variety of products, and ensure interaction with scientists from various science institutions. The strategy has five components: (1) informal consultations, (2) state-of-the-science reviews, (3) a science team, (4) forums for input to plan alternatives, and (5) science information-sharing events. These components are explained individually in the following text.

Informal Consultations

Members of the RMP planning team face significant challenges in analyzing the effects of alternatives. The scope and multi-scaled nature of the analytical questions that must be addressed, along with scientific uncertainties underlying these questions, create a high level of analytical complexity. Informal consultations and small group meetings to provide early and rapid feedback among planning team members and scientists regarding proposed analysis methods were organized and conducted to prepare the planning criteria. Draft descriptions of proposed analytical methods were shared with scientists, and the scientists responded with suggestions to improve the analysis. Scientists from Oregon State University, the Pacific Northwest Research Station, and the U.S.Geological Survey-FRESC have assisted BLM through informal consultations about climate change, fish, hydrology, landscape ecology, social and economic values, soils, timber harvest systems, timber growth and yield modeling, and wildlife.

State-of-the-Science Reviews

The BLM is working with scientists who have recognized expertise in relevant fields to conduct "State-of-the-Science" reviews for selected major issues and questions. The

purpose of these reviews is to assess the state of the knowledge and to identify areas of agreement and uncertainty for complex issues central to the resource management plan revisions. These reviews will include a survey and synthesis of existing literature, a list of questions that are the subject of ongoing scientific investigations, and a suggested range of reasonable assumptions and interpretations relevant for the Western Oregon Resource Management Plan Revisions. Reports will be prepared in a format suitable for review and use by the BLM planning team, and possibly may be further developed for publication. These reviews will help focus and support the analyses of planning team specialists, and also identify potential tools to help conduct resource analyses.

Topics currently being developed by scientists from Oregon State University, the Pacific Northwest Research Station, and U.S. Geological Survey - Forest and Rangeland Ecosystem Science Center (FRESC) in consultation with the BLM are:

- Wildlife use of dead wood
- Forest management effects on peak stream flows
- Aquatic habitat management strategies
- Human community resiliency
- Application of landscape dynamics concepts
- Young stand management

Note: The last two projects are funded by Region 6 of the Forest Service under terms of the settlement agreement between the American Forest Resource Council/USDA-USDI.

Science Team

A Science Team consisting of government scientists has been formed to enhance the quality and credibility of the analyses for the Western Oregon Resource Management Plan Revisions. Participation of nonfederal scientists is sharply limited by provisions of the Federal Advisory Committee Act (FACA).

The Science Team is comprised of scientists from the National Marine Fisheries Science Center, Oregon Department of Environmental Quality Laboratory, Pacific Northwest Research Station, Region 6 of the Forest Service, and the U.S.Geological Service-FRESC. A list of the members on the Science Team is provided in Appendix A, including their area of expertise and science review in the plan revisions process.

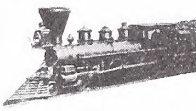
The Science Team is tasked to:

- Review the modeling assumptions and analysis methodologies proposed for assessing the environmental effects of plan alternatives.
- Review the effects analysis.
- Provide input to alternative development.
- Provide advice on monitoring and adaptive management processes.
- Review proposed changes between the draft and final plans.

The team provides advice to the BLM and is not expected to provide an independent certification of science consistency.

Forums for Input to Plan Alternatives

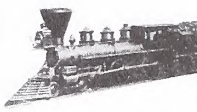
Many scientists in the region have extensive experience translating broad concepts into management strategies. Involvement of scientists in the alternative development process can broaden the range of options and identify innovative ways to integrate management approaches to achieve objectives of the resource management plans. The BLM will capitalize on existing collaborations with science partners through brainstorming exercises, field trips, workshops, scenario modeling exercises, or other appropriate means to provide concepts and strategies for consideration in RMP alternatives. Existing



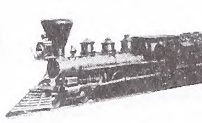
partnerships include: Coastal Landscape Analysis and Modeling Study (CLAMS), Cooperative Forest Ecosystem Research (CFER) program, BLM Density Management and Riparian Buffer Study, and the Central Cascades Adaptive Management Area.

Science Information-Sharing Events

Much has been learned since the Northwest Forest Plan was created in 1993-1994, and there is a high level of interest regarding the use of science in the BLM's Western Oregon Resource Management Plan Revisions. The BLM intends to organize public information-sharing events to present key science findings that provide foundations for aspects of the resource management plan revisions. These events may take the form of a general conference, or may occur as a series of field trips with scientists, cooperators, and interested members of the public. The events could be scheduled during development of the Draft Environmental Impact Statement or after its publication.



Chapter 3 Analytical Methods and Techniques



Introduction

This chapter guides analysis of controversial or complex effects. These effects analyses will form the basis for most of the discussions of environmental consequences in the Environmental Impact Statement.

There is an overview of vegetative modeling, which plays a major role in the planning process, followed by sections on the following resources and programs:

- Ecology
- Social and Economic
- Timber and Silviculture
- Special Forest Products
- Bureau Special Status Species - Plants and Fungi
- Invasive Plants
- Wildlife
- Fisheries
- Hydrology
- Fire and Fuels Management
- Air Quality
- Recreation
- Soils
- Livestock Grazing
- Wild Horses
- Special Areas
- Heritage and Paleontological Resources
- Lands and Roads
- Minerals

There is a set of analytical questions and a description of how each question will be answered in the effects analysis for each resource or program.

Specific analysis pertinent to the extensive non-forest ecosystem in east Klamath Falls Resource Area is yet to be developed.

Format

Each resource or program will be presented in its own section, with formatting as follows:

Analytical Question #1

- Analytical Assumptions
- Analytical Methods and Techniques
- Analytical Conclusion
- Data Needs
- Data Display
- Questions for Scientists
- References

Explanation of Terms

Analytical Questions

Alternatives are addressed in two ways:

- To what extent do the land use allocations and management direction meet the goals and objectives of the alternative?
- What are the environmental consequences associated with the land use allocations and management direction of the alternative?

Analytical questions are focused and specific to issues, resource or objectives.

Analytical Assumptions

- These are the science and relationships of the natural systems that will be used in analysis of the alternatives.
- The assumptions are not general lists of true statements regarding a resource, but rather only those used in the analysis.
- Assumptions may include thresholds or measures of acceptability or goodness.

Analytical Methods and Techniques

- Analytical method is the what (use of a particular model, quantitative approach, qualitative approach).
- Analytical technique is the how (outline of step-by-step process for analysis, use of data).
- May be qualitative or quantitative.
- May consist of procedures or models from experimental forests, scientific papers, previous environmental impact statements, and procedures developed by BLM specialists.

Analytical Conclusion

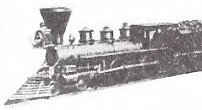
- Description of the kinds of conclusions (quantitative, qualitative, ranking, weighing) expected from the information and analysis.
- Description of how conclusions will be used to describe environmental consequences and to compare alternatives.
- Given the analytical assumptions, analytical methodology, and analytical technique, the analytical conclusion must be repeatable by other professionals.

Data Needs

- Description of what specific data is needed.
- Description of how and why the data will be used in analysis.
- Highly detailed and complex data will generally not be used to do qualitative analysis to reach broad conclusions.

Data Display

- Description of how information, analysis, and conclusions will be displayed to effectively tell the story. May be tables, graphics, maps, and photographs.

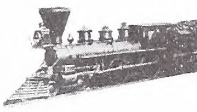


Questions for Scientists

- Technical assistance needed from scientists regarding questions, assumptions, methodologies, and techniques.

References

- Scientific references in support of analytical assumptions, methodologies, and techniques.



Vegetation Modeling Overview

Introduction

The alternatives considered in the plan revisions will outline a range of approaches for managing the BLM forest lands by varying the land allocations and intensity with which these forests are managed. These different management approaches will result in a range of outcomes in terms of the characteristics of the forest over time, types of habitat developed, and sustainable harvest levels. A model is used to simulate development of the forest over time under these various management strategies. The model can simulate application of management practices and forest development assumptions to characterize what the forest will be in 10, 20, 50, 100+ years into the future. The outputs from modeling will form a factual basis for comparing different land management strategies of the alternatives.

Model Selection Criteria

The primary purposes for modeling vegetation is to make projections of endangered species habitats and calculation of a sustainable harvest level. It was desirable to utilize one model for both purposes so the data and assumption related to the alternatives would be common for both objectives. A spatially explicit model was desirable because it allows for development of map-based scenarios of implementation, for both short and long-term assessment of the alternatives. The model needed to be capable of processing large areas, such as the Medford District (862,000+ acres). Management strategies such as the Northwest Forest Plan, which has multiple management strategies implemented over individual forest stands, require the model to be capable of simulating these complex strategies. One such example is a regeneration harvest area retaining 6 to 8 green trees and having intermingled riparian reserves to be thinned, but only if the watershed has 15% or greater in late-successional forest on Federal lands. The model also needed to be mature from a software standpoint, with a proven track record.

The OPTIONS model by D.R. Systems best met the criteria listed above. The Washington Department of Natural Resources' use of OPTIONS in the development of their recent management plans, under very similar circumstances, was influential in the decision to select this model. Information about this model is online at: <http://www.drsystemsinc.com/prod_options.html>.

Formulating the Model

A model at times is referred to as a "black box" that is too complex to understand and thus cannot be trusted. The very nature of the work of simulating the development of 80,000+ forest stands, over 2.5 million acres, for many decades, under management scenarios that involve multiple objectives, goals, and constraints is complex. One way of understanding the modeling work is to focus on individual components used to formulate the model. The OPTIONS model itself comes with no data and should be viewed as a modeling tool. The BLM is responsible for the data and assumptions utilized in formulating the model for analyzing the alternatives.

Land Use Allocations

There are land use allocations that are common across all alternatives. Examples are: Congressionally Withdrawn areas; Timber Productivity Capability Classification

(TPCC) areas that are not biologically capable of supporting a sustained yield of forest products; existing roads; West Eugene Wetlands; and the Cascade Siskiyou National Monument. GIS modeling will be utilized to spatially depict the Northwest Forest Plan riparian reserves and other riparian management strategies for the alternatives. Land use allocations of the existing plan are being mapped in GIS. These include: recreations sites, Areas of Critical Environmental Concern, Known Owl Activity Centers, Northwest Forest Plan Late-Successional Reserves, Adaptive Management Areas, and Occupied Marbled Murrelet sites.

For the analysis of effects, GIS maps will be produced to depict allocations specific to each alternative. These GIS allocation data layers are also inputs for the OPTIONS model. The model will utilize this information and the land management rules applicable to each allocation to determine which lands contribute to the sustainable harvest level and which lands do not. These allocations direct which set of management prescriptions are applied to the current forest conditions for projection into the future. The Draft Environmental Impact Statement will describe, for each alternative, the GIS allocation data that was utilized in the modeling, as well as management rules and assumptions that were applied. These data will be available to the public upon publishing of the Draft Environmental Impact Statement.

Vegetation

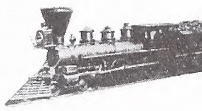
The Forest Operations Inventory (FOI) has mapped in GIS 80,000+ forest stands across the 2.5 million acres of the BLM lands. The Micro*Storms database provides attributes for these stands to describe age, species composition, size classes, stocking classes, site index (productivity), and the history of past management treatments. These data will be utilized in the model in many ways. Stands will be grouped into like stand conditions based on their past management history (Existing Stand Conditions ESC). Stands will be classified into structural stages to describe existing and future forest conditions. Species groupings will be used to identify the predominant types for use in projecting both habitat and timber yields. Productivity (site index) classes enable differentiation and recognition of the natural variation in growth rates and achievement of stand characteristics over time.

The Current Vegetation Survey (CVS) is a permanent plot grid inventory across both the BLM and Forest Service lands. There are approximately 1,300 plots on BLM-managed lands within the planning area. Forest Service CVS data from adjacent ecologically similar areas can also be used to supplement the BLM inventory data. The CVS data will be the basis for empirical growth and yield curve development for existing stands, as well as for assessment of onsite silvicultural treatment responses.

The ORGANON growth model will be used to develop the managed stand yields. Information bout that model is online at: <http://www.cof.orst.edu/cof/fr/research/organon/>. Yield curves will be developed for each species group and site class combination that will be modeled. Yield curve development will be based on similar ecological conditions and will span across districts. The Current Vegetation data will also be used to populate the Forest Operations Inventory units with representative lists of trees and/or stand data.

Prescriptions – Treatment Regimes

The current resource management plan for each district describes the sivlicultural prescriptions and/or treatment regimes for the current plan (No Action Alternative). These treatment regimes describe intermediate thinning treatments, use of genetically improved stock, fertilization, conditions for regeneration harvest, and type of legacy elements retained after harvest. These treatment regimes are associated with current and



planned land use allocations, as described by the No Action Alternative. The alternatives will define and apply different allocation strategies and treatment regimes to the land base, and the outputs can be assessed relative to desired resource objectives. In the current plans, no estimation of effects was provided for density management treatments within the late-successional or riparian reserves. It is anticipated that the revised plans will make estimates of the treatment opportunities and estimates of timber outputs for the reserve land components.

Habitat Development

The Northwest Forest Plan monitoring program produced habitat maps for the Northern Spotted Owl and Marbled Murrelet. These classifications will be analyzed with the CVS data to develop parameters that can be used in modeling to predict when stands will develop into habitat conditions for these two wildlife species. This same rule set will be applied to the existing vegetation data to form current condition baselines. It is a goal to be consistent with these Northwest Forest Plan baselines and to use similar parameters in the projections within the scenarios. Other resources, such as fisheries and Special Status Species, will utilize the projected stand conditions and structural stages to assess their programs under the alternatives.

Constraints and Goals

The OPTIONS model provides a powerful analytical framework to apply constraints and goals or targets that reflect the management strategy of the alternatives. OPTIONS is referred to as a "Scenario-Based" model, because it applies the constraints of an alternative along with the management goals and then performs management actions within that framework. Within the OPTIONS model design, timber harvesting is a residual activity; all other environmental targets and objectives must be met first. Additionally, OPTIONS is a rule-based simulation model and does not attempt to optimize the timber harvest. Rather, the model attempts to display the effects of rules and regulations on a given land base. As a result, this scenario-based approach provides realistic, spatial forecasts of the effects of management rules and environmental regulations. These forecasts of effects can be displayed, analyzed, tracked and explained in a more straight-forward manner than with optimization-based models.

An example of a goal or target would be the 15% retention Standard and Guideline under the current plan. The 15% S&G requires that federal ownership within a fifth-field watershed must be above 15% late-successional and old-growth forest (LSOG) before regeneration harvest may occur. The model maintains a dynamic inventory of the late-successional old growth (LSOG) acreage in each fifth-field watershed. Prior to any harvest treatment occurring, the model calculates potential effects of each individual treatment to determine if application of the treatment will violate the 15% Standard and Guideline. If the treatment violates the rule, the treatment will not be applied.

Another example of a goal would be to place priority for performing fuels management treatments within the wildland urban interface (WUI). The area within the WUI would be identified through GIS and loaded into the model. The first priority for treatments would be applied to that area before similar treatments are applied outside of that area.

Constraints are most easily thought of as area-based or volume-based restrictions on activities within a specified area. Once the constraint level has been reached, then no more activity of that type can take place anywhere within affected polygons until the required waiting period or stand response characteristics has been achieved. A simple example of a constraint could be the requirement that a percentage (such as 8%) of a harvest unit must be retained. Setting this up as a constraint implies that up to 92% of the area is available for harvest. Once the 92% had been harvested, no more commercial

harvesting of timber would be allowed within that remaining 8% for the specified waiting period, which is often for a rotation or longer.

Both goals and constraints can be applied in combination with other goals or targets, or with other constraints.

Formulating the Model is a Work in Progress

Many inputs into the model will be common across all alternatives. These are currently in the process of being formulated. The initial work is being done on a test basis on the No Action Alternative, to develop the methodology, using a small part of the planning area. The Draft Environmental Impact Statement will provide further details on the components that go into the model for each alternative. Data utilized in the model for the Draft alternatives will be available to the public with the publication of the Draft Environmental Impact Statement.

BLM and Context Modeling

The OPTIONS modeling will be applied to the approximately 2.5 million acres of BLM-managed lands within the planning area. The surrounding private, state and other Federal lands comprise approximately 22 million acres. The level of detail utilized in modeling for the BLM-managed lands cannot be developed within the revision timelines for projecting the non-BLM lands. Context vegetation modeling for the non-BLM lands will be done by applying these assumptions to the Interagency Vegetation Mapping Project satellite image vegetation classification that was done for the Northwest Forest Plan monitoring. The Ecology section gives analytical assumptions for the change in vegetation conditions for the non-BLM lands in the planning area.

Products

- *Land Base Maps* - The GIS land use allocations will outline which lands are designated to specific uses, such as Areas of Critical Environmental Concern and recreation sites. These land base maps are used in the model to designate which lands support the sustainable harvest level.

- *Starting Condition Baselines* – The starting conditions of the forest vegetation (October 2005) and baselines for Northern Spotted Owl Habitat and Marbled Murrelets will be mapped in GIS.

- *Projection of Forest Conditions* – The model will project development of the forest under the alternatives for many decades into the future. The effects analysis will utilize both numeric and spatially explicit displays of development of the forest over time. This will be used to quantify and display conditions of the forest, structural stages, and Northern Spotted Owl and Marbled Murrelet habitats.

- *Test of Sustained Yield* - The long-term projection of forest conditions will also illustrate that the management practices for an alternative will provide for sustained yield (non-declining even flow), as required under the O&C Act.

- *Projection of Management Treatments* – The model tracks the types of treatments over time (short and long term), both numerically and spatially.

- *First Decade Scenario* - Treatments simulated in the model for the first decade will be utilized to develop a "first decade scenario." This will provide for an estimate of short-term change to the forest and display of the types of treatments that are applied. It will also serve as a basis to estimate road construction needs and assess harvest methods.

Uses for These Products

- *Analysis of Effects* – The model will provide an assessment of changes to key baselines, such as Older Forest, and Spotted Owl and Marbled Murrelet habitats. The vegetation conditions maps and expression of structural stages will serve many other programs in assessing the change in vegetation conditions for their resource.

- **Inputs For Other Models** - The outputs from OPTIONS will feed other modeling efforts. For example, the Ecology section will analyze the spatial patterns created with the use of the FRAGSTATS model. Information about the FRAGSTATS model is available online at: <http://www.umass.edu/landeco/research/fragstats/fragstats.html>.

- *Aid in Understanding Forest Dynamics* – The alternatives will explore a variety of management regimes and allocation strategies. The dynamics of how the current forest responds to these strategies in the short and long term can be complex to understand by numbers alone. The addition of the spatial display over time of how the forest develops under the alternatives will inform both the agencies and the public.

- *Basis for Consultation* – The spatial display of change over time at such large scale has never been available for the consultation process. This expanded view of how species habitats listed under the Endangered Species Act will develop over time should provide a basis to tier to in the future and to reduce subsequent consultation workloads.

- *Guide to Implementation* – The model will simulate a scenario of implementation that reflects the relative magnitude of the types and amounts of land management activities expected from implementing the plans. This can serve as a guide to implementation and a comparison point to monitor compliance with the plans over time.

- *Cost of Implementation*. - The assessment of first decade treatments with associated road construction and logging methods will provide a basis for estimating the cost of implementation.

Resources and Resource Uses

Ecology

Analytical Question #1

What is the landscape vegetative pattern and how does it depart from historic conditions?

Analytical Assumptions

- Landscape patterns will be described in terms of patches (Forman 1995). This is in contrast to describing the landscape in terms of *gradients*.
- Private lands will continue to provide the same amount and distribution of vegetation classes over time.
- For Forest Service lands, forests in reserve allocations will continue to grow and matrix lands will continue to provide the same amount and distribution of vegetation classes over time.
- The large blocks of State lands (the Tillamook and Elliott State Forests) will be coarsely modeled based on their current management plans.
- Older forests, especially in large blocks, will be a priority for conservation, because they provide habitat for a wide range of species, including at-risk species, and because they have declined substantially from historic conditions (USDA et al.1993; Shaugnessy and O'Neil 2001, pp. 159-160).

Analytical Methods and Techniques

- Define patches in terms of the following vegetation classes:

(A) **Non-forest**

(B) **Forest**

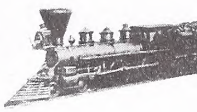
(1) Stand Establishment
- Without Structural Legacies
- With Structural Legacies

(2a) Young High Density
- Without Structural Legacies
- With Structural Legacies

(2b) Young Low Density
- Without Structural Legacies
- With Structural Legacies

(3) Mature
- Single Canopy
- Multiple Canopy
- (In Ponderosa Pine, Grand Fir, and Douglas-fir Series: Dense Understory/Open Understory)

(4) Structurally Complex
- Existing Old Forest
- Existing Very Old Forest
- Developed Older Forest Structure
- Developed Very Large Older Forest Structure



- (In Ponderosa Pine, Grand Fir, and Douglas-fir Series: Dense Understory/Open Understory)

All classes will also be subdivided as conifer, hardwood, or mixed.

- Define thresholds for each class by the following clusters of plant series:
  - Western Hemlock and Tanoak
  - Douglas-fir
  - Grand Fir, White Fir, Pacific Silver Fir
  - Ponderosa Pine

- Classify patches on BLM-managed lands based on existing stand condition class (see Timber and Silviculture). Discrete contiguous units of land within a single vegetation classification will be classified as patches. Map patches over time (years 10, 20, 30, 40, 50, and 100) based on the OPTIONS computer model output.

- Classify patches on non-BLM lands based on data from the Interagency Vegetation Mapping Project (IVMP).

- Keep patch amount and distributions on private lands and Forest Service matrix lands static over time (years 10, 20, 30, 40, 50, and 100).

- Grow stands in Forest Service reserve allocations over time (years 10, 20, 30, 40, 50, and 100).

- For the Tillamook and Elliott State Forests, use Oregon State analyses to project coarse-scale patterns over time (years 10, 20, 30, 40, 50, and 100).

- Calculate amount of each vegetation class over time (years 10, 20, 30, 40, 50, and 100); sum at fifth-field watershed and terrestrial physiographic province.

- Use the computer model FRAGSTATS (McGarigal et al. 2002) to calculate diversity and abundance of patch types and patch size. Calculate patch diversity using a diversity index (such as Shannon's Diversity Index) and patch evenness (distribution of area among patch types, measured by an evenness index, such as Shannon's Evenness Index). (Evenness will be used in Analytical Question #3). Measure connectivity by connectance and patch cohension indices (McGarigal et al. 2002; Schumaker 1996).

- Calculate abundance of large patches (>50 acres; >200 acres; >2,000 acres; >10,000 acres) at fifth-field watershed and province.

- Compare patch abundance to historic range of variability, described by existing modeling (Wimberly et al. 2000) and descriptions of reference conditions from Rapid Assessment Reference Condition Models (USDA Forest Service and USDI BLM unpublished).

Analytical Conclusion

- Rank of alternatives by:
  - Total amount of older forest.
  - Amount of older forest in large patches.
  - Patch diversity at the fifth-field watershed scale.
  - Connectivity of mature and structurally complex patches.

- Rank of alternatives by their departure from historic conditions, based on comparison of patch abundance by groups of plant series and at the province scale.

Data Needs

- BLM-managed lands by Existing Stand Condition (ESC) codes, reclassified by vegetation classes.
- Data from the Interagency Vegetation Mapping Project (IVMP) for non-BLM lands, reclassified by vegetation classes.
- Oregon State analyses for future conditions on Tillamook and Elliott State Forests.
- Forest Service land use allocation map from the Northwest Forest Plan.
- OPTIONS spatial outputs at years 10, 20, 30, 40, 50, and 100.
- Vegetation classes for Forest Service reserve lands at years 10, 20, 30, 40, 50, and 100. (Methodology to derive Forest Service vegetation classes yet to be determined).

Data Display

Overall vegetation abundance and pattern, displayed in:

- Stacked bar graphs showing abundance of vegetation classes by alternative, at years 10, 20, 30, 40, 50, and 100.
- Flow diagrams (boxes and arrows) of vegetation classes with acres for each alternative at years 10, 50, and 100.
- Maps of vegetation classes by alternative for a few example fifth-field watersheds for illustrative purposes at years 10, 50, and 100.

Patch Diversity

- Line graph showing patch diversity at province scale by alternative over 100 years.
- Maps classifying fifth-field watersheds by patch diversity by alternative.

Older Forests

- Line graph showing abundance of total older forest at province scale by alternative over 100 years.
- Line graph showing abundance of large patches of older forest at province scale by alternative over 100 years.
- Line graph showing abundance of existing older forest at province scale by alternative over 100 years.
- Maps classifying fifth-field watersheds by amount of large patches of older forest by alternative.
- Maps classifying fifth-field watersheds by amount of older forest by alternative.

Historic Range of Variability

- Table comparing fifth-field watershed and province-scale patch diversity and amount of older forest with historic range of variability.

Questions for Scientists

- Are there additional sources to describe *"historic range of variability?"*
- Can regional or landscape targets be developed for patch abundance and diversity? (The Habitat Objectives in the Partners in Flight Conservation Strategy provide one example; are there others?)

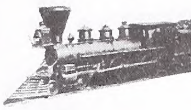
Analytical Question #2

How resistant are stands to disturbance?

Analytical Assumptions

- Stand resistance to disturbance describes the magnitude of change in stand structure in response to disturbance. The greater the resistance, the less the stand is changed by disturbance.

- Variations in stand-level resistance to disturbance are most pronounced in young stands. Stands at low density are more resistant than stands at high density.



- Stands at lower tree density maintain higher vigor, and therefore are more resistant to drought stress and insect attack. (However, stands at lower tree density are not necessarily more resistant to some diseases, such as Swiss Needle Cast, Port-Orford-cedar root disease, and Laminated Root Rot).

- In high density stands, individual trees may become structurally unstable, increasing their potential for windthrow or stem breakage (Scott 2005; Wonn and O'Hara 2001; Wilson and Oliver 2000, Oliver and Larson 1990)

- Stands at lower densities are generally in lower fire regime condition class and are more resistant to severe fire.

Analytical Methods and Techniques

- Classify stand resistance to disturbance by vegetation class, as shown on the following table.

Classification of Stand Resistance to Disturbance, by Vegetation Class		
Vegetation Class	**Low Resistance to Disturbance**	**High Resistance to Disturbance**
Stand Establishment	All	None
Young	High Density	Low Density
Mature	Dense Understory	All Others
Structurally Complex	Dense Understory	All Others

- Calculate acres of "high resistance" or "low resistance," at 10-year intervals over 100 years; sum at fifth-field watershed and province.

Analytical Conclusion

- Rank of alternatives, by percentage of landscape in "high resistance" stands.

Data Needs

- OPTIONS outputs

Data Display

- Line graph showing acres of "high resistance" by alternative at 10-year intervals over 100 years.
- Maps of stands of "high resistance" or "low resistance" by alternative for a few example fifth-field watersheds for illustrative purposes at years 10, 50, and 100.

Analytical Question #3

How resilient is the landscape?

(How much can the landscape change and continue to provide key functions, such as provision of habitat and connectivity of habitat?)

(Are potential replacements available if a desired vegetation class is lost to disturbance?)

Analytical Assumptions

- Resilience describes how quickly the landscape recovers from disturbance to a pre-disturbance condition.

- Measure "evenness" (such as Shannon's Evenness Index) of patch distribution at the fifth-field watershed and province scale.

Analytical Conclusion

- Rank of alternatives by landscape resilience: evenness of target vegetation classes.

Data Needs

- OPTIONS outputs
- Forest Service vegetation analyses from Analytical Question #1
- Oregon State lands vegetation analyses from Analytical Question #1

Data Display

- Table displaying fifth-field watershed and province-scale patch evenness (or departure from target evenness).

Questions for Scientists

- Can a target amount of each vegetation class be described, or should evenness be measured?
- Should evenness be measured only among certain target vegetation classes: Stand Establishment with Legacies, Young Low Density, Mature Multiple Canopy, and Structurally Complex Forest?

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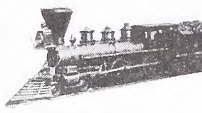

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Social and Economic

Analytical Question #1

How will the alternatives affect communities in the western Oregon planning area?

Analytical Assumptions

- Effects on community resiliency indicators will be used to analyze social and economic impacts of alternatives and to address economic stability of local communities and industries, as stated in the O&C Act. Community resiliency, which is generally defined as the social and economic capacity to adapt to change (see upcoming Community Resiliency Technical report by Richard Haynes and Ellen Donoghue of the Pacific Northwest Research Station) will be shown using measures including changes in employment and income, as well as other factors (as discussed below). Typically, communities with larger populations and higher levels of diversity in employment are considered to be resilient.

- Timber supplies from other major timber suppliers including Forest Service, other government, and private ownerships will be based on their existing plans and current trends.

- The potential timber price changes and volume responses of other ownerships to the alternatives will be discussed. An increase in supply of BLM timber could lead to decreased stumpage prices and in turn to decreased supply by other ownerships.

Analytical Methods and Techniques

Step #1. Determine each alternative's effect on community resiliency in the planning area as measured by: (1) changes to employment and income, and (2) other factors, such as population changes, employment trends, economic diversity, distance from interstate corridors, and commuting distances.

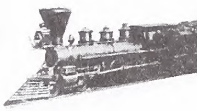
In general, effects on individual local communities will be discussed in qualitative terms. Data sets for models are not readily available at smaller than the county scale.

- *Changes to employment and income in the planning area*.
  These changes will be estimated using an input/output model such as IMPLAN. The input/output analysis will be performed at multiple scales including state, western Oregon, aggregate (combined) counties, and individual county level to show changes in job and income based on alternative levels of resource flows such as timber and agency expenditures. Community will be defined at different levels for different data sets and will include scales smaller than the county level. Projections for jobs and income will be for each alternative for the first decade. Jobs, income and timber supplies will not be projected for specific communities or locales.

  Historic flows of timber from previous mill study reports will be used in deciding which of the 18 western Oregon counties will be combined for aggregate county-level analysis.

  The Economic Profile System (EPS) will be used to provide context for the affected environment.

- *Other factors* that will be used to evaluate community resiliency include, but are not limited to: trends in population changes, employment trends, degree of economic



diversity, poverty, distance from interstate corridors, and commuting distances. These factors will be assessed based on current data. The evaluation process will be as follows:

- Communities will be ranked into categories based on level of resiliency.
- Rankings will be reviewed by local leaders to affirm rankings.
- Categories of communities will be described from less resilient to more resilient.
- Communities will be screened within the resiliency categories and placed into one of two groups based on primary wood products industry employment levels. One group will be communities with primary wood product employment levels being greater than 10 percent of total employment; the other will be communities that have less than 10 percent of total employment in the primary wood products industry.
- Communities will then be categorized into two groups based on percentage of revenue sharing from timber receipts/county payments. Those in counties where the county budget consists of greater than 40 percent will be in one group, and those with less than 40 percent will be in another group.
- After communities have been stratified based on levels of resiliency, percent of primary wood products industry employment, and percent of revenue sharing as part of county budget, sample communities will be randomly selected from each group using the computer to show effects of alternatives on resiliency indicators for individual communities.

The Forest Economic Assessment Spreadsheet Tool (FEAST) is an impact calculator used by the U.S. Forest Service. It supplements IMPLAN and summarizes, by alternative, various impacts being considered, such as timber and agency expenditures. FEAST allows all inputs to be modified simultaneously to calculate changes in jobs and income per sector.

The Community Level Economic Model Program is an input/output model similar to IMPLAN, but at the community (city or town) level. This program will be used to analyze selected communities. Communities will be selected based on several factors, including level of resiliency and availability of data sets to run models.

The overall change in Oregon's economy will be as shown in the Economic Forecast for Oregon prepared by the Oregon Office of Economic Analysis, which is available online at: <http://www.oea.das.state.or.us/DAS/OEA/economic.shtml#Economic_Forecast>.

Step #2. Price effects for stumpage prices will be estimated using the Forest Service's Timber Assessment Market Model (TAMM).

Analytical Conclusion

- Ranking of alternatives based on whether communities within the planning area are likely to have high, medium, or low resiliency to effects of the alternatives.
- Narrative will include reasons and magnitude of impacts on different types of communities.

Data Needs

- Data to analyze community resiliency, jobs, and income:
  - County-level demographic data.
  - Program outputs, by alternative, for programs including timber, recreation, etc.
- Timber supply, by district and alternative.
- For stumpage prices: Timber Assessment Market Model (TAMM): timber demand elasticity.

- Cost of agency implementation by alternative.

Data Display

- *Communities*
  - Data for community resiliency will be displayed using color-coded maps that will be supported by narrative text.
  - Data for jobs and income will be displayed in tables and supported by narrative text.

- *Timber Supplies*
  - Table

- *Stumpage Prices*
  - Table

Analytical Question #2

What will be the cost to the BLM in terms of staff requirements and dollars to implement alternatives?

Analytical Assumptions

- This is a financial analysis and will only include BLM budget required by alternative.

Analytical Methods and Techniques

- Each resource/resource use will have an estimated cost of implementation, which will also be used as inputs to the FEAST model described in Analytical Question #1. Additionally, a cost/benefit analysis will be done for the timber program as shown in Analytical Question #3.

Analytical Conclusion

- Comparison, at the alternative level, of budget needs with historical trends.

Data Needs

- Program cost estimates by alternative.

Data Display

- Findings will be displayed in table format and supported by narrative text.

Analytical Question #3

What is the value of the timber management program under each alternative in today's dollars?

Analytical Assumptions

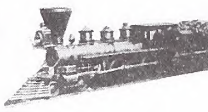
- This is a financial analysis and will only include cash flow costs and benefits incurred directly by the BLM.

Analytical Methods and Techniques

- The present net value will be computed for each alternative under two scenarios: (1) no change in timber prices, and (2) a one percent annual increase in timber prices.

- Only costs and revenues of the timber program will be included.

- Revenues and costs for a 50-year period beginning with implementation of the revised plans will be discounted to the date of implementation. The discount will depend on varying discount rates, including the Real Discount Rate from OMB Circular A-94, Appendix C, available online at:



<http://www.whitehouse.gov/omb/circulars/a094/a94_appx-c.html>

"Log lines" <,http://www.logprices.com/>

<http://www.odf.state.or.us/DIVISIONS/management/asset_management/LOGPPAGE.asp>

- District timber sale planning data will also be used to compute stumpage values and logging costs.
- All price, cost, and interest data will be in real dollars and be net of overall inflation in the economy. The alternatives will be ranked by present net value, from high to low.

Analytical Conclusion

- An estimate of economic efficiency for the alternatives, indicating the net costs and benefits to taxpayers.

Data Needs

- Timber volume and price
- Logging costs
- Agency expenditures

Data Display

- Data ranking will be displayed in table format, with a narrative description.

Analytical Question #4

What will be the effect of alternatives on O&C timber fund receipts distributed to the counties?

Analytical Assumptions

- Current distribution method will continue unchanged into the reasonably foreseeable future.
- Timber values will remain constant in real terms (net of inflation).

Analytical Methods and Techniques

- The amount of revenue shared with each O&C county will be estimated for each alternative based on current distribution methods. The 18 western Oregon O&C counties currently receive 50 percent of BLM timber receipts where fifty cents of every dollar generated goes to the counties. Distribution of funds among the 18 counties is based on a fixed amount of O&C acreage in each county. Alternatives will be ranked by amount of monies to counties.

Analytical Conclusion

- Rank of alternatives by their effect on county revenues.
- Effects on counties due to changes in timber receipts will vary relative to the percent of the county budget that county payments provide. Alternatives will be ranked based on total dollars to counties.

Data Needs

- Revenue data.

Data Display

- Color-coded map displaying amount of revenue income by county.

Timber and Silviculture

Analytical Question #1

How will stands and inventory of merchantable timber volumes change as a result of the alternatives?

Analytical Assumptions

- Current Vegetation Survey (CVS) plots and the Forest Operations Inventory (FOI) form the best available data set to construct inventory, standing volume, and yield projections for the planning area.

Analytical Methods and Techniques

- FOI and CVS data will be used for the starting timber inventory.
- The U.S. Forest Service CVS data will be considered for use when suitable and where BLM data cannot be effectively supplemented.
- To group vegetation stands, individual CVS plot data will be stratified into ecologically similar conditions.
- Forest Operations Inventory (FOI) units will be assigned an Existing Stand Condition (ESC) code to reflect current stand condition and past treatment history, and a species group to reflect stand composition.
- Starting timber volume [*cubic feet & Scribner 16 feet*] will be calculated using CVS plot data and FOI acreage stratifying by existing stand condition code, species group, age, and site productivity.

Analytical Conclusions

In 10-year increments:

- Total standing volume, by alternative over time, and over all land allocations.
- Age class by acres over time, by alternative over time, and total merchantable volume within age classes.

Data Needs

- Output from harvest scheduler
- Growth and yield projections

Data Display

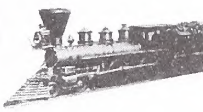
- Graph displaying standing volume by alternative over time, at 10-year increments by district.
- Table or graph displaying age class distribution, by alternative over time, at 10-year increments by district.

Analytical Question #2

What is the annual productive capacity of the available forestlands under the various alternatives?

Analytical Assumptions

- Funding for projects and staffing will be available for silvicultural practices and harvest operations.
- The annual productive capacity will vary, depending on which harvest practices, silvicultural treatments, and land allocations are included within each alternative.



Analytical Methods and Techniques

- A suite of available harvest, reforestation, and stand development tools will be developed for each alternative, including but not limited to: silvicultural systems, harvest methods, regeneration, genetic improvement, stand conversion, fertilization, density control, and pruning.

- Growth projection of silvicultural prescriptions, yield curves, and stand structural characteristics (including mortality and coarse woody debris production) will be evaluated using appropriate versions of the ORGANON growth and yield model (Hann 2003), CONIFERS young stand simulator (Ritchie 2005), and RVVM young stand model (Shula et al. 1998).

- Develop treatment response curves for OPTIONS model for suite of treatments selected.

- Yield projections will be reduced where appropriate to reflect:
  - Harvest defect and breakage
  - Insects and disease
  - Non-stocked openings
  - Soil productivity loss (effect of compaction on tree growth)
  - Green-tree retention
  - Down woody debris (DWD) retention
  - Density-independent mortality at older ages in extended rotation scenarios
  - Losses from prescribed fire

- Timber Productivity Capability Classification (TPCC) will be used in determining the lands capable of supporting the production of forest products on a sustained yield basis.

- Sensitivity analysis will be conducted to determine the effects of varying silvicultural treatments within each alternative.

- Annual productive capacity will be calculated and declared at the district level.

Analytical Conclusion

- Annual productive capacity for each district, by alternative.

Data Needs

- Updated uneconomical/unfeasible analysis for timber harvest operability.
- District review of silvicultural prescriptions, to be used as input assumptions in the OPTIONS model.

Data Display

- Annual productive capacity, by district.

Analytical Question #3

What quantity and mix of timber products will result from the alternatives, what level of harvest methods will be used, and what levels of silvicultural treatments will be applied?

Analytical Assumptions

- Markets will be available for the timber commodity volumes produced, and high quality logs will continue to command a premium, although not necessarily at historical levels (Haynes 2003, Haynes and Fight 2004).

- An amount of timber equal to the Annual Productive Capacity will be offered each year.

- Markets for biomass may emerge in some districts within 10 years.

Analytical Methods and Techniques

- The output of the OPTIONS model will be used to generate harvest scenarios for analysis that will be reviewed by districts to incorporate effects, such as road construction amounts and harvest methods used.
- The starting inventory, stand yield curves, and silvicultural prescriptions will be used to project the anticipated timber output from harvest actions.
- Anticipated log sizes and grades from treatments will be developed using historical data and stand projections.
- Units harvested by the OPTIONS modeler and analyzed by the districts will be summarized by sustained yield unit to project the total mix of volume, acres, log sizes, and log grades harvested by district.
- Silvicultural treatments necessary to implement the silvicultural prescriptions will be summarized over time in 10-year increments. Anticipated treatments to ensure effective reforestation and desired stand trajectory will be developed from historical experience and modeling within ORGANON.
- Commodity quality and value produced by the various silvicultural systems will be done using BLM appraisal methods.
- Biomass estimates will be developed using harvest action levels, silvicultural treatment levels, and anticipated fuels treatment actions.

Analytical Conclusion

- Log sizes and grades
- Acres of harvest actions
- Levels of silvicultural treatments

Data Needs

- Output from harvest scheduler
- District review of 10-year scenarios

Data Display

- Display in 10-year increments by district:
  - Acres of harvest types.
  - Anticipated timber outputs, including estimates of log sizes and grades.
  - Silvicultural treatments by treatment type.

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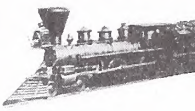

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Special Forest Products

Analytical Question #1

How does each activity and alternative affect the type and quantity of special forest products?

Analytical Assumptions

- Special forest products are vegetative resources harvested across all public lands.
- Many plants and fungi that provide a harvestable product require a specific habitat and may require a specific host.
- New forest products continue to be developed, markets will increase, and harvest quantities will continue to grow. Recreational wildcrafting is one of many non-commercial activities that is growing.
- The demand for special forest products varies as new markets develop or dwindle and can be cyclical from year to year, depending on seasonal variation or environmental factors such as mushroom species.
- The availability of access, particularly roads to harvest areas, influences the amount and type of products available for harvest.

Analytical Methods and Techniques

- Construct and compare special forest products by:
  - o Annual harvest quantity
  - o General habitat
  - o Host species
  - o Length of time for a species to recover from disturbance to a commercial yield.
- Utilize existing data sources, such as current vegetation surveys, forest operations units, existing data bases and Geographic Information System (GIS) data, Timber Sale Information System (TSIS) data, and botany surveys.
- Compare each species response to management activities (thinning, fuels reductions, brushing, etc.).
- Identify existing or probable special forest products areas.

Analytical Conclusions

- Comparisons and contrasts of the effects on special forest products, by activity type and alternatives.

Data Needs

- Timber Sale Information System data, including harvest products, locations and quantities.
- Determination of the available quantities and sustainability of each special forest product within a management unit.

Data Display

- Tabular format, as in representative table templates shown below.

Notes:

- All data in the following tables is hypothetical and non-factual data.
- Additional special forest products will be included.

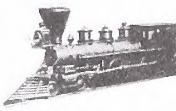

Table 1. Comparison of Special Forest Products and Key Features.				
Primary Special Forest Products Harvested on BLM Lands	**Annual Harvest Amount***	**General Habitat**	**Host Species/ Associates**	**Expected Recovery Time After Major Disturbance**
Manzanita	80,000 lbs.	Chaparral	None	30 years
Matsutaki Mushrooms	20,000 to 50,000 lbs.	Mixed hardwood/ conifer stands	Numerous hardwood and conifer species	60 years
* Estimated values based on multiple data sources.				

Table 2. Comparison of Special Forest Products and Anticipated Response by Activity Type (Relative change: slight improvement, slight decline, or neutral).						
Products	**Management Actions**					
	Timber Harvesting			**Fuels Reduction**		
	Thinning	**Density Management**	**Regeneration Harvest**	**Slashbuster**	**Manual Cutting**	**Grazing**
Manzanita	slight decline	neutral	slight decline	slight decline	slight decline	Neutral
Matsutaki Mushrooms	neutral	neutral	slight decline	slight decline	slight improvement	Neutral
Firewood	slight improvement	slight improvement	slight improvement	neutral	Neutral	Neutral

Table 3. Comparison of Special Forest Products and Anticipated Response by Alternatives (Relative change: slight improvement, slight decline, or neutral).					
	Alternatives				
Products	**No Action**	**Alternative #1**	**Alternative #2**	**Alternative #3**	**Alternative #4**
Manzanita	neutral	neutral	slight decline	neutral	Neutral
Matsutaki Mushrooms	neutral	neutral	substantial decline	neutral	Neutral
Firewood	neutral	neutral	slight improvement	neutral	Neutral
Christmas Trees	neutral	slight decline	substantial improvement	neutral	Neutral
Moss	neutral	slight improvement	substantial decline	slight decline	slight decline

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Bureau Special Status Species - Plants and Fungi

Analytical Question #1

How will each activity (such as timber harvesting, fuels reduction treatments, quarry development, easements, etc.) affect habitat, and what are the habitat characteristics that will change? Which Bureau Special Status Species (BSSS) plant and fungi functional groups will these habitat changes affect?

Analytical Assumptions

- Many Bureau Special Status Species plant and fungi are associated with a specific plant series, habitat type, and ecological feature, whereas other rare species are more generalists and associated with broad habitat types. Rare plant and fungi generally are not regularly distributed or predictable across the landscape, even when good potential habitat exists.

- Most Bureau Special Status Species plant and fungi species can be organized into functional groups on the landscape based on biotic and abiotic characteristics and response to disturbance.

- Any single Bureau Special Status Species will not always occur in a single functional grouping, but may be placed in multiple groups.

- Functional groups occurring in hardwood and conifer forested areas will be affected by proposed actions more than non-forest groups.

- Occurrences of Bureau Special Status Species endemic to conifer stands will not receive the full array of conservation measures available to species that occur on non-conifer lands and public domain lands. If tools or techniques are limited, the likelihood of some species ability to persist will diminish.

- Some Bureau Special Status Species (such as Gentner's fritillaria, Kincaid's lupine and many annuals) are adapted to frequent natural disturbances, whereas other species are adapted to long periods of stable habitat conditions. Natural disturbances affect species differently and may create a positive or negative habitat change depending on the type, intensity, and frequency of the disturbances.

- Some management activities (such as density management and fuels reduction treatments) can achieve desired habitat change when carefully designed and implemented.

- The correlation between potential habitat (habitat that currently exists, or is suitable and available for occupancy) and rare plant species occurrence varies greatly among species and may not provide a good indicator. Several factors play important roles in determining species rareness and distribution. Those factors include disease, predation, inbreeding depression, pollination, consumption by herbivores, weed invasion, lack of connectivity, reproductive strategies, habitat change, and global climate change.

- Pre-project inventories for fungi species will not be conducted. Consequently, there exists a higher degree of risk and uncertainty with fungi species and the relationship between occurrences, habitat and impacts from activities. If inventories are not conducted prior to projects, some occurrences will likely be lost. The number of lost occurrences will be difficult to estimate.

- Non-federal lands contribute minimally to conservation of Bureau Special Status Species and their habitat.

- Habitat change will be described over a range of years with short-term increments of 3 years and long-term increments at 10, 25, 50 and 100 years. The life-forms of most Bureau Special Status Species are annuals, bi-annuals, or perennials and respond quickly to disturbance.

- Site data in the BLM regional database (GeoBob) is likely to overstate the actual number of occurrences and individuals per population due to the historical age of the occurrence data and lack of revisits and monitoring.

Analytical Methods and Techniques

- Primary data sources that will be used are: BLM GeoBob database (occurrence, population, habitat and inventory), Oregon Natural Heritage database, Oregon Flora Project, Soil Conservation Service county soil survey data, Jepson Manual of Higher Plants of California, The Flora of the Pacific Northwest, the 2004 Supplemental Environmental Impact Statement on Survey and Manage biological data, the Forest Ecosystem Management Assessment Team (FEMAT), and the Northwest Forest Plan. The Eugene District BLM special habitat layer in GIS will be reviewed to determine its utility.

- Forest Operations Inventory (FOI), Current Vegetation Survey (CVS) plot data, soils series data, and plant series groups will be used to characterize and assess current vegetation conditions and ecological characteristics by gross acres.

- Review current GeoBob tabular data for Bureau Special Status Species occurrences, population data, habitat data, and area inventoried. Use GeoBob spatial data to analyze species distribution and density.

- Construct a matrix of all Bureau Special Status Species by site and key ecological data components, such as life-form, life-cycle, plant series, soil characteristics, disturbance regime, canopy closure, geology, elevation, slope and aspect (representative list).

- Analyze matrix data using PC.ORD software. Primary analyses proposed are hierarchical agglomerative cluster analysis and non-metric multi-dimensional scaling.

- Determine functional groups from PC.ORD results, rankings, and district botanists' expertise and familiarity with occurrences of Bureau Special Status Species and their habitat.

- Develop matrix showing functional groups, proposed activities, habitat characteristics changed, how habitat would change, and groups affected.

- List habitat change qualitatively by activity as "improved," "declined" or "remained the same."

- Segregate functional groups that are non-woodland associated from woodland associates.

- Determine and compare the total number of occurrences by species in Oregon and on BLM-managed lands.

Alternative Method to Using PC.ORD Software

If data is not available or adequate to use PC.ORD, the alternative is to overlay GIS plant series layer on BLM-managed lands with GeoBob data of Bureau Special Status Species

plant and fungi and known site locations. Determine functional groups from district botanists' expertise and familiarity with occurrences of Bureau Special Status Species and their habitat.

Analytical Conclusions

- Describe the habitat characteristics that would be modified, as well as how the habitat changes by activity type.
- Describe which groups would be affected.
- Describe anticipated habitat quality change (improved, declined or neutral) for each functional guild affected by activities in the short-term and long-term context (3, 10, 25, 50 and 100 years).

Data Needs

- List of anticipated activities (timber harvesting, fuel treatments, grazing etc) with acres of disturbance and the general location or project activity centers.
- Oregon Natural Heritage database.
- GeoBob data.

Data Display

Note: Example tables below have false data; used only to show table structure.

- Table showing a list of Bureau Special Status Species, along with their status, Oregon Natural Heritage ranking, and total number of known occurrences in Oregon and on BLM-managed lands. See example table below.

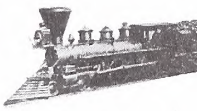
Bureau Special Status Species, Along With Their Status, Oregon Natural Heritage Ranking, and Known Occurrences in Oregon and on BLM-managed Lands.

Nacode	Taxon	Scientific Name	Common Name	BLM Status	ONHP Ranking	Oregon Total Occurrences	BLM Total Occurrences
ARMA33	VA	Arabis MacDonaldiana	MacDonald's Rock-Cress	FEO	1	5	0

- Table showing list of functional groups with habitat characteristics and species. See example table below.

Functional Groups with Habitat Characteristics and Species

Function Group Name	Habitat Characteristics	Representative Bureau Special Status Species
Freshwater Ecosystem Associates		
Wet Meadows (AWM)	Intermittent/seasonally wet grasslands	*Plagiobothrys hirtus*, *Viola primulifolia* ssp. *Occidentalis*
Terrestrial Ecosystem Associates		
Forest Edge (TFE)	Ecotones between openings and forests	*Fritillaria gentnerii*, *Lupinus sulphureus* ssp. *Kincaidii*
Geologic Type Associates		
Serpentine (GS)	Upland serpentine endemics	*Lomatium cookie*



- Table listing management activities by treatment type (timber harvesting-regeneration harvest, tractor, helicopter, etc.) and habitat characteristic affected, effects to habitat, and groups associated with habitat.

Management Activities and Their Effects			
Management Activity	**Habitat Characteristics Likely Affected**	**Potential Effects to Habitat**	**Functional Groups Affected (by code)**
Timber Harvesting	Increased canopy openings	Increase in sunlight and precipitation on the forest floor	TDFM, TWF, THC,
Regeneration Harvest	Slash accumulation	Increase in organic debris. Reduced germination.	TDFM, TWF, THC

- Table showing Functional Groups and Anticipated Habitat Quality Change by activity at 3, 10, 25, 50, and 100 years. See example below.

Functional Groups and Anticipated Habitat Quality Change, by Management Activity, at Various Years						
Management Activities	**Habitat Quality Change: Improve, Decline, Neutral**	**Functional Groups Affected**				
		3 years	**10 years**	**25 years**	**50 years**	**100 years**
Timber Harvesting						
Regeneration Harvest	Improve	*AWM, GS		TDFM, TWF, THC	TDFM, TWF, THC	TDFM, TWF, THC
	Decline	TDFM, TWF, THC		AWM, GS	AWM, GS	AWM, GS
	Neutral	TFE	TFE	TFE	TFE	TFE
Grazing	Improve					
	Decline					
	Neutral					
*AWM, GS,TDFM – Functional group acronyms.						

Analytical Question #2

How does each alternative affect habitat, and how will Bureau Special Status Species (BSSS) plant and fungi functional groups respond?

Analytical Assumptions

- Bureau Special Status Species plant "hot spots" occur in western Oregon in regions reflecting floristic diversity and habitat quality.
- Bureau Special Status Species and functional groups will be affected and will respond differently by alternative based on different types of activity, as well as the intensity and distribution of activities across the landscape.
- The response to habitat disturbance by functional groups can be categorized as "improve," "decline," or "neutral," and may differ in short-term and long-term timeframes.
- Non-federal lands will contribute minimally to conservation of rare species occurrences and habitat.

Analytical Methods and Techniques

- Use the functional groups constructed earlier, habitat and occurrence data.
- Determine probable distribution (geographic area), as well as types and intensities of activities, by alternative relative to Bureau Special Status Species functional groups.
- Overlay Bureau Special Status Species occurrences and use nearest neighbor analysis ("hot spot map") of rare species.
- Overlay results with 5th field watershed map and rank.

Analytical Conclusions

- Describe the relative degree of habitat change to functional groups (improve, decline or neutral) by alternative. Look at watershed level and regional scales.

Data Needs

- Data from previous analytical question.
- 5th field watershed map.

Data Display

- Map of watersheds coded into five categories of occurrence levels by watershed of Bureau Special Status Species occurrences that range from "no documented occurrences" through "high levels of known occurrences (hot spots)."
- Table showing habitat groups and relative change (improve, decline, neutral) in functional groups, by alternative. See example table below.

Habitat Groups and Relative Change in Functional Groups, By Alternative

	Alternatives				
Functional Groups	**No Action**	**Alternative 1**	**Alternative 2**	**Alternative 3**	**Alternative 4**
Forest Edge (TFE)	neutral	Decline	decline	decline	decline
Mixed Hardwoods/ Conifers Guild (THC)	slight improvement	Substantial improvement	substantial decline	substantial improvement	substantial decline

References

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Meinke, R. J. 2003. Evaluating the Taxonomic Bias in Our Endangered Species Acts: Potential for Unprotected Diversity in the Oregon flora.

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Invasive Plants

Analytical Question #1

How would each alternative affect invasive plant introduction and spread?

Analytical Assumptions

- X noxious weed species and Y non-noxious weed listed, invasive plant species have been discovered in the planning area (X and Y numbers yet to be derived).

- An accurate accounting of the total acreage and distribution of invasive plant infestation and treatments is not possible, because no central source exists for compiling invasive plant infestation and treatment information within Oregon; and because there is no requirement for private or corporate landowners, or counties to report invasive plant infestation or treatment information.

- All invasive plant species have unique strategies for spread and resistance to certain treatment methods. However, species by species analysis will not be done because the relative success of invasive plant species varies under different site and environmental conditions. Attempting to calculate the rate of spread of all invasive species known within the planning area that are operating independently under a wide variety of environmental conditions is not feasible.

- Data for the current distribution of these species is available from a combination of sources including:

  - WeedMapper, a new and not yet fully populated web-based spatially referenced database of noxious weeds managed by the Oregon Department of Agriculture in partnership with the Bureau of Land Management, U.S. Forest Service, and the Rangeland Resources Department at Oregon State University.

  - Oregon Department of Agriculture and County Weed Coordinators.

  - District Weed Coordinator records.

  - Oregon Knotweed Working Group meeting notes (March 2005).

  - False-brome Working Group webpage with the most recent reported sites (April 2005) and a potential habitat model developed in May 2005, online at: <http://www.appliedeco.org/FBWG.htm>.

- Natural vectors (such as humans or animals) or natural forces (such as wind or water) will continue to spread invasive plants; reduction of spread to zero is not possible.

- Geographic areas that serve as the primary source locations for invasive plants include roads and other travel ways, high recreation use areas, urban areas, and gravel sources.

- The amount of soil disturbance and increased in light conditions resulting from the implementation of an alternative has a strong correlation with the amount of invasive plant species introduction and spread that would be expected.

- Most ground-disturbing activities in the planning area are associated with recreational activities, and vegetation and road management.

- Regeneration harvest activities create higher light levels than density management and commercial thinning activities. Commercial thinning harvests result in lower light levels than density management harvests. (Personal communication Bob Ohrn, 12/2/2005).

- Soil disturbance from timber harvest includes bared soils.

- More soil is disturbed with ground-based methods than from skyline cable systems. Aerial logging systems disturb less soil than ground-based and skyline cable systems. (McClelland, personal communication, 12/5/05).

- Alternatives resulting in higher levels of disturbance in and near riparian habitats are more likely to generate riparian infestations than those further removed from riparian habitats.

- Stream crossing locations are common sites of new riparian associated infestations.

- Areas designated *"open"* to off-highway vehicle use are more likely to have new invasive species introductions and more spread than areas designated as *"limited"* or *"closed."* Areas designated *"closed* to off-highway vehicle use" are least likely to have new introductions and spread of invasive plants associated with off-highway vehicle use.

- Invasive plant infestations associated with riparian areas tend to spread downstream over time as seeds and vegetative propagules (such as a cutting, seed, or spore) are carried downstream. Several invasive species (including false brome, knotweed complex species and some knapweeds) are known to spread in this manner, as well as by terrestrial pathways.

- Infestations associated with roads and trails tend to spread along those corridors.

- Infestations are introduced and spread more readily in areas having more human activity, such as in wildland urban interface and high recreational use areas.

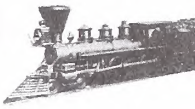
- Road management activities involving disturbance to soil and increased light levels contribute to the spread of invasive species. These kinds of activities include road construction, road closures, weather proofing, ripping, pulling and replacing culverts, cleaning ditches and like activities.

- Infestation spread is likely to be more severe in watersheds where disturbance activities are well distributed than in watersheds where the disturbance activities are concentrated.

- Disturbance activities located throughout the watershed, generally at the higher elevations in watersheds are more likely to spread more broadly through the watershed via transportation corridors and stream systems than those which are concentrated in the lower elevations in association with wildland urban interface areas.

- Knotweeds, false brome, Himalayan blackberry, and Scotch broom tolerate moderate levels of shade.

- Spotted and meadow knapweeds, Canada thistle, Dyers woad, leafy spurge and yellow starthistle can be described as being fairly shade intolerant.



Analytical Methods and Techniques

- Use yellow starthistle, the knotweeds, false brome, spotted knapweed, meadow knapweed, Himalyan blackberry, Scotch broom, Dyers woad, Canada thistle, and leafy spurge as examples of invasive plant species in this analysis.

- The Current Invasive Plant Species table in the U.S. Forest Service's Pacific Northwest Region Invasive Plant Program: *Preventing and Managing Invasive Plants* FEIS (April 2005) will be adapted to reflect a sample of the invasive plant species known to occur within the planning area on BLM-managed lands.

- For each alternative, sub-alternative, and sensitivity analysis use the requested maps and consider the proposed vegetation management activities in the tables to assess the relative likelihood of invasive plant species introduction and spread.

- Many steps described below will use a spreadsheet format as part of the following analytical step and to display results.

Step 1 - Determine the current Species Distribution Category (SDC) at the fifth-field watershed level:

For each invasive plant species, use location information from WeedMapper, Cooperative Weed Management Area, or District or species working group data sets to determine the current distribution level using the categories described below.

There are three Species Distribution Categories (SDC) based on the known species distribution in the fifth-field watersheds: abundant, limited, and low.

Abundant (SDC value of 5) = The species has been reported from more than 25% of the square miles within the fifth-field watershed.

Limited (SDC value of 3) = The species has been reported from between less than 25% and more than 1% of the square miles within the fifth-field watershed.

Low (SDC value of 1) = The species is reported in no more than 1% of the square miles in the fifth-field watershed.

Note: The 25% threshold value is a place holder until the botany issue/support team can validate or discuss an appropriate value.

Step 2 – Conduct analysis of vegetation management for likelihood of inadvertent introduction of invasive plant species.

Step 2a - Assign an increased light level coefficient (Ilc) to represent the relative likelihood of inadvertent introduction from increased light levels associated with different kinds of timber harvests. Use the following values:

Regeneration harvest = 0.5
Density management = 0.3
Commercial thinning = 0.1

Step 2b - For each invasive species, calculate the relative likelihood of inadvertent introduction from different kinds of timber harvest activities by using the following equations:

To determine relative likelihood of inadvertent introduction from regeneration harvest (LIIr), use: LIIr = (SDC)(.5)(probable # acres of regeneration harvest/ decade)

To determine relative likelihood of inadvertent introduction from density management (LIId), use: LIId = (SDC)(.3)(probable # acres of density management/ decade)

To determine relative likelihood of inadvertent introduction from commercial thinning (LIIc), use: LIIc = (SDC)(.1)(probable # acres of commercial thinning/ decade)

Step 2c - Assign a soil disturbance coefficient (sdc) to represent the relative likelihood of inadvertent introduction of invasive plants from soil disturbance associated with different logging systems. Use the following values:

Ground-based yarding = 0.5
Cable yarding = 0.3
Helicopter logging = 0.1

Step 2d - For each invasive species, calculate relative likelihood of inadvertent introduction from different kinds of vegetation management activities by using the following equations:

To determine relative likelihood of inadvertent introduction from ground-based yarding (LIIgb), use: LIIgb = (SDC)(.5)(probable # acres of ground-based yarding/ decade)

To determine relative likelihood of inadvertent introduction from cable yarding (LIIcy), use: LIIcy = (SDC)(.3)(probable # acres of cable yarding/decade)

To determine relative likelihood of inadvertent introduction from helicopter logging (LIIhl), use: LIIhl = (SDC)(.1)(probable # acres of helicopter logging /decade)

Step 2e – Determine likelihood of combined timber harvest for inadvertent introduction value (LIIth)

To determine combined value factors in contributions of increased light and soil disturbance associated with timber harvest activities, use:
LIIth = (LIIr + LIId +LIIc + LIIgb + LIIcy + LIIhl)/2

Step 3- Conduct riparian analysis to address likelihood of inadvertent introduction of invasive plant species into riparian systems.

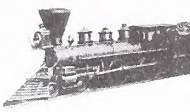
Step 3a -Assign a stream crossing category (SCC) for each fifth-field watershed.

Use hydrographic and ground transportation data to determine approximately how many stream crossings BLM manages in each fifth-field watershed on BLM-managed land. Exact figures are not needed to derive a relative ranking. Use the following values:

High (value of 5) = # of stream crossings are managed by BLM /BLM-managed acres in the watershed is greater than X?

Moderate (value of 3) = # of stream crossings are managed by BLM /BLM-managed acres in the watershed is greater than ??? less than XXX.

Low (value of 1) = # of stream crossings are managed by BLM /BLM managed-acres in the watershed is than XXX.



Note: The range of values for # stream crossings/BLM-managed acres in the scenario fifth-field watersheds is yet to be determined. After the range of values is determined, then a division between high, moderate and low could be established.

Step 3b - Use the equation below in determining the likelihood of inadvertently introducing each species into riparian areas at stream crossings.

LIIrip_scc = (SDC)(scc)(miles of stream managed by BLM in the watershed)

Step 3c - Assign a riparian coefficient (rc) to reflect the likelihood for inadvertent introduction for riparian-associated invasive species with regard to various riparian reserve widths.

The broadest riparian reserves will have a riparian coefficient (rc) of 0.1 and the narrowest riparian reserves will have a value of 0.5.

Step 3d - Calculate the relative likelihood of inadvertent introductions into riparian areas in a fifth-field watershed for each species considering the relative proximity of riparian reserve widths for each alternative.

To determine relative likelihood for inadvertent introductions into riparian areas considering riparian reserve widths = LIIrip_rc, use the following equation:

LIIrip_rc =
(SDC)(riparian coefficient$_1$)(miles of stream on BLM-managed land associated with the same riparian reserve width) +
(SDC)(riparian coefficient$_3$)(miles of stream on BLM-managed land associated with the same riparian reserve width) +
(SDC)(riparian coefficient$_5$)(miles of stream on BLM-managed land associated with the same riparian reserve width)

Step 3e - Provide a riparian summary by calculating the likelihood of inadvertent introduction of invasive plant species into riparian systems considering inputs from both stream crossings and management activities in relatively closer proximity to streams.

The following calculation would be done for each species in each alternative, sub-alternative, and sensitivity analysis:

LIIrip_rc/scc = LII_rc + LII_scc

Step 4 - Conduct analysis of Off-Highway Vehicle Designations to address likelihood of inadvertent introduction of invasive plant species.

Step 4a -Assign off-highway vehicle designation values, as identified below, to each part of the watershed having a different OHV designation.

Off-Highway Vehicle Designation Values:
Open = 0.5
Limited = 0.3
Closed = 0.1

Step 4b – For each species, calculate the relative likelihood of inadvertent introductions related to off-highway vehicle use. Conduct the calculations by using the OHV designations in combination with species distribution categories. Use the following equation:

(SDC)(OHV designation value)(miles of roads and trails in the designation) = relative likelihood of OHV related inadvertent introduction.

Step 5 - Invasive Plant Potential of Spread Analysis based on elevations of activities.

Step 5a – Determine spread ratings for timber harvest activities concentrated at different elevations in the watershed.

Use fifth-field watershed maps and hydrographic maps in combination with the areas of the greatest amount of proposed timber harvest activity to assign an elevation rating for timber harvest activities for each alternative. Use the following equations:

Timber activities concentrated in the higher elevations = SPe value of 0.5
Timber activities concentrated in the middle elevations = SPe value of 0.3
Timber activities concentrated in the lower elevations = SPe value of 0.1

Step 5b – Determine spread ratings for road management-related disturbance activities concentrated at different elevations in the watershed.

Use fifth-field watershed maps and hydrographic maps in combination with proposed locations of the highest road management activity areas to describe where in the watershed the greatest amount of road management activity is expected.

Road management activities involving disturbance to soil and increased light situations (building, closing, weather proofing, ripping, pulling and replacing culverts, cleaning ditches, brushing, and like activities) are given priority in this analysis. General road maintenance activities like grading gravel roads shouldn't be considered.

Assign an SPe rating for road management activities for each alternative, according to the following:

Road Management Activities concentrated in the higher elevations = SPe value of 0.5
Road Management Activities concentrated in the middle elevations = SPe value of 0.3
Road Management Activities concentrated in the lower elevations = SPe value of 0.1

Step 5c – Determine spread ratings for off-highway vehicle designations.

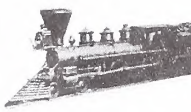
Use fifth-field watershed maps and hydrographic maps in combination with the off-highway vehicle designation maps to describe where in the watersheds the greatest amount of OHV use is expected for each alternative. Use the following values:

"OHV closed" designations higher in the watersheds = SPe value of 0.1
"OHV limited" designations higher in the watersheds = SPe value of 0.3
"OHV open" designations higher in the watersheds = SPe value of 0.5

This may not be a necessary analysis, depending on how broad the off-highway vehicle designations are for the selected analysis fifth-field watersheds.

Step 5d – Determine spread ratings for recreation sites, areas, trails and national Backcountry Byways.

Use fifth-field watershed maps and hydrographic maps in combination with the recreation sites, areas, trails and national Backcountry Byways maps to put areas of



concentrated recreational use into one of three broad elevation categories: higher, moderate or lower elevations. Use the following values:

Recreation use concentrated in the higher elevations = SPe value of 0.5
Recreation use concentrated in the moderate elevations = SPe value of 0.3
Recreation use concentrated in the lower elevations = SPe value of 0.1

Step 6 – Conduct spread analysis considering disturbance activity locations with respect to wildland urban interface and high recreation use areas.

Step 6a – Determine spread ratings for timber harvest activities concentrated in relative proximity to areas with a lot of human activity.

Use fifth-field watershed, wildland urban interface, and recreation maps in combination with the areas of the greatest amount of proposed timber harvest activity to assign an SPhuman activity rating for timber management activities for each alternative. Use the following values:

Timber Activities concentrated well outside of wildland urban interface areas and high recreation use areas = SPhuman activity value of 0.5

Timber Activities concentrated in close proximity to wildland urban interface areas and high recreation use areas = SPhuman activity value of 0.3

Timber Activities concentrated within wildland urban interface areas and high recreation use areas = SPhuman activity value of 0.1

Step 6b – Determine spread ratings for road management-related disturbance activities concentrated in relative proximity to areas with a lot of human activity.

Use fifth-field watershed maps, wildland urban interface, and recreation maps in combination with proposed locations of the highest concentrations of road management activity areas. This comparison will be used to determine where the proposed road management activities are expected to be located in relation to areas of concentrated human activity.

Assign an SPpeople rating for road management activities for each alternative, using the following values:

Road Management Activities concentrated well outside of wildland urban interface areas and high recreation use areas = SPpeople value of 0.5

Road Management Activities concentrated in close proximity to wildland urban interface areas and high recreation use areas = SPpeople value of 0.3

Road Management Activities concentrated within wildland urban interface areas and high recreation use areas = SPpeople value of 0.1

Step 6c – Determine spread ratings for off-highway vehicle *"Open"* and/or *"Limited"* designations in relative proximity to areas with a lot of human activity.

Use fifth-field watershed maps, wildland urban interface, and recreation maps in combination with off-highway vehicle designation maps to describe where in the areas designated as off-highway vehicle *"Open"* and or *"Limited"* are in relation to areas of concentrated human activity.

Assign an SPpeople rating for off-highway vehicle *"Open"* designated areas for each alternative, using the following values:

OHV *"Open"* and/or *"Limited"* designated areas are concentrated well outside of wildland urban interface areas and high recreation use areas = SPpeople value of 0.5

OHV *"Open"* and/or *"Limited"* designated areas are concentrated in close proximity to wildland urban interface areas and high recreation use areas = SPpeople value of 0.3

OHV *"Open"* and/or *"Limited"* designated areas are concentrated within wildland urban interface areas and high recreation use areas = SPpeople value of 0.1

Step 6d – Determine spread ratings for recreation sites, areas, trails and national Backcountry Byways (high recreation use areas) concentrated in relative proximity to wildland urban interface areas

Use maps of fifth-field watersheds and wildland urban interface areas, in combination with the recreation maps, to describe where high use recreation areas and wildland urban interface areas are in relation to one another.

Assign an SPpeople rating for high recreation use areas for each alternative, using the following values:

High recreation use areas are concentrated well outside of wildland urban interface areas = SPpeople value of 0.5

High recreation use areas are concentrated in close proximity to wildland urban interface areas = SPpeople value of 0.3

High recreation use areas are concentrated within wildland urban interface areas = SPpeople value of 0.1

Step 7 - Conduct spread analysis considering the relative distribution of disturbance activities.

For each spread potential activity category considered in Steps 5a–5d, assign an SPd rating as described below:

Concentrated activities = SPd value of 0.1
Moderately dispersed = SPd value of 0.3
Dispersed activities = SPd value of 0.5

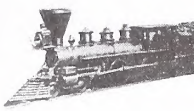
Analytical Conclusions

- *Timber Harvest Analytical Conclusions for Likelihood of inadvertent introduction of invasive plant species.*

Comparison of the LII values for each species for each alternative, showing the relative likelihood of introduction into the watershed as a by-product of the varying levels of different kinds of anticipated timber management activities.

Higher LLIth values indicate more opportunities for introduction.

- *Stream Crossing Analytical LII Conclusions*



Summary of the relative LIIrip scc values for each species, for each alternative, addressing the relative likelihood of introducing these species into riparian areas at stream crossings.

- *Riparian Reserve Width LII Analytical Conclusions*

  Summary of the relative LIIrip_rc values for each species, for each alternative, addressing the relative likelihood of introduction into the riparian areas as a result of varying the riparian reserve widths.

  Higher LLIrip_rc values indicate more opportunities for invasive plant introduction into riparian areas and vice versa.

- *Combined Riparian LII Analytical Conclusions*

  Summary of the relative LIIrip_rc/scc values for each species, for each alternative, addressing the relative likelihood of introduction of these species into the riparian areas as a result of varying riparian reserve widths and considering the amount of BLM-managed stream crossings in the watershed.

  Higher LLIrip_rc/scc values indicate more opportunities for invasive plant introduction into riparian areas and vice versa.

- *Off-highway vehicle Designation LII Analytical Conclusions*

  Summary of the relative LIIohv values for each species, for each alternative, addressing the relative likelihood of the species introduction into new locations based on off-highway vehicle designations.

  Higher LIIohv values indicate more opportunities for invasive plant introduction and vice versa.

- *Spread Analysis is done three ways*: (1) activities as they relate to elevational bands, (2) distribution of activities, and (3) activities considered in their relative proximity to areas of high human activity.

  Relative differences in the potential spread of the invasive species in the watershed will be described, based on the general elevations where activities and processes associated with spread are likely to occur.

  Relative differences in the potential spread of the invasive species in the watershed will be described, based on the distribution of disturbance activities are within the watershed.

  Relative differences in the potential spread of the invasive species in the watershed will be described, based on their relative proximity to areas of high human activity.

Data Needs

Fifth-field watershed maps and tables for each alternative with the following kinds of information:

- Timber harvest activities – scenarios for probable acres and location of timber harvest activities organized by regeneration harvests, commercial thinning and density management and logging method (ground based, cable systems, helicopter logging) from the OPTIONS model.

- Ground transportation with BLM-managed miles.
- Hydrography to a scale that would show stream crossings.
- Off-highway vehicle designations.
- Recreation sites, areas, trails, and national Backcountry Byways.
- Wildland urban interface
- Distribution maps on a square mile grid for false brome, knotweed complex, spotted knapweed, meadow knapweed, Canada thistle, Dyers woad, leafy spurge, Himalayan blackberry, Scotch broom, and yellow starthistle.

Data Display

- Maps, summary tables from Excel worksheets, and narratives.

References

U .S. Department of Agriculture, Forest Service. 2005. Pacific Northwest Region Invasive Plant Program: Preventing and Managing Invasive Plants Final Environmental Impact Statement Volume III. Appendix B. Current Invasive Plant Species on National Forest Lands in the Pacific Northwest Region: pp 1-16.

Oregon Knotweed Working Group Meeting Minutes. March 15, 2005. <http://www.nwcb.wa.gov/PNWKNOTWEED/OR_working_group/KWG_mttg_minutes_3_15_05.doc>

WeedMapper species distribution maps. September 2005. <http://www.weedmapper.org/maps.html>

False-brome Working Group webpage. May 2005. <http://www.appliedeco.org/FBWG.htm>

Wildlife

Analytical Question #1

What levels of spotted owl habitat will be available under each alternative?

Analytical Assumptions

- Nesting habitat suitability will be evaluated, based on relationships between biotic and abiotic factors and the locations of occupied sites. Vegetative data will be derived from Forest Operations Inventory (FOI) and/or Current Vegetation Survey (CVS) data. This relationship will serve as a benchmark against which habitat suitability or similarity is measured (Davis and Lint in press). Relationships will be established for the Oregon Coast Range, Oregon Western Cascades, Southwest Oregon, and Oregon Eastern Cascades physiographic provinces. These relationships will be necessary to account for habitat and prey differences.

- The nesting habitat suitability relationship will not change over time. The relationship, once established based on current owl occupancy, will be used throughout the analysis to compare the amount of habitat available under differing alternatives and at differing times into the future.

- Dispersal habitat is defined as conifer or conifer/hardwood stands with diameter at breast height (dbh) of 11 inches and canopy closure of 40 percent (Thomas et al 1990; Davis and Lint in press).

- Thomas et al. (1990) established a threshold of 50 percent dispersal habitat within a quarter-township as providing for good landscape dispersal. Dispersal habitat will be quantified by sixth-field watershed as it represents an analysis unit comparable to quarter-township in size.

- Not all federal lands are capable of developing suitable owl habitat. Either the lands are not capable of growing forests (rock outcrops, barren lands, or snow covered), or the forests that grow are not capable of developing into habitat useable by the northern spotted owl (serpentine soils, high elevation).

- Spotted owl critical habitat does not change within analysis period.

Analytical Methods and Techniques

- Habitat derived by BioMapper (v 3.0) (Hirzel et al. 2004) (Davis and Lint, in press) will be used to establish relationships with the current Forest Operations Inventory/ Current Vegetation Survey strata, which will then be used to map habitat.

- Percentages will be based on the amount of habitat-capable forests (forested stands capable of developing into suitable spotted owl habitat).

- Habitat quantities will be modeled at years 0, 10, 20, 30, 40, 50, and 100 for all alternatives. Ten-year and 100-year timeframes represent short-term and long-term impacts necessary for consultation purposes; 20-50 years represents an intermediate timeframe that will be useful for determining speed of recovery/stability.

Analytical Conclusion

- Relative value of each alternative to develop and maintain spotted owl habitat across the landscape and throughout time, based on changes in the percentages of available spotted owl habitat, patch size, and connectivity. Barred owl influences, West Nile Virus, sudden oak death syndrome, and effects to prey base will be factored into the final analysis.

Data Needs

- BioMapper – To derive habitat relationships.
- Forest Operations Inventory (FOI) and/or Current Vegetation Survey (CVS), Digital Elevation Models (DEM), and physiographic provinces – To establish current relationship between occupied owl sites and biotic and abiotic factors. Data will then have to be rasterized to run through BioMapper.
- Critical Habitat map – To segregate unit of analysis.
- Fifth-field watershed map – To segregate unit of analysis.
- ORGANON and OPTIONS outputs – Use in conjunction with habitat relationship developed at time zero to quantify suitable habitat
- Forest-capable and Habitat-capable masks (developed by Davis and Lint, in press) – To identify federal lands with a potential to develop into suitable owl habitat.

Data Display

- Maps to display habitat suitability indices.
- Graphs to compare habitat levels by watershed, by alternative and through time.

References

Hirzel, A.H., J. Hausser, and N. Perrin. 2004. Biomapper 3.0. Div. of Conservation Biology, Bern, Switzerland. <http://www.unil.ch/biomapper/>.

Davis, R.J. and J.B. Lint. in press. Chapter 3 Habitat Status and Trends. In: Northwest Forest Plan – The First Ten Years (1994-2003): Status and trend of northern spotted owl populations and habitat. J. Lint (tech. coord.). USDA Forest Service Pacific Northwest Research Station, Portland, OR.

Zabel, C.J., J.R. Dunk, H.B. Stauffer, L.M. Roberts, B.S. Mulder, and A. Wright. 2003. Northern spotted owl habitat models for research and management application in California (sic) (USA). Ecological Applications 13(4):1027-1040.

Analytical Question #2

What levels of marbled murrelet habitat will be available under each alternative?

Analytical Assumptions

- The Expert Judgment Habitat Model (Raphael et al. in press) will serve as the basis for developing a suitable habitat model.

- The nesting habitat suitability relationship will not change over time; the relationship, once established, will be used throughout the analysis to compare the amount of habitat available under differing alternatives and at differing times into the future.

- Not all federal lands are capable of developing murrelet habitat; either the lands are not capable of growing forests (for example: rock outcrops, barren lands, or snow covered), or the forests that grow are not capable of developing into habitat useable by the murrelet (for example: serpentine soils or high elevation).

- Critical habitat does not change within the analysis period.

- The analysis area will be marbled murrelet zones 1 and 2 (as BLM defines Marbled Murrelet Zone coverage) for Salem, Eugene, Roseburg, and the northern portion of Coos Bay; and zones A and B in Medford and the southern portion of Coos Bay (approximately a 6.5-mile buffer of the western hemlock type).

Analytical Methods and Techniques

- Habitat suitability class 4 in the Expert Opinion Model (Raphael et al. in press)

was judged to best approximate suitable murrelet habitat. Relationships between this model and the Forest Operations Inventory/Current Vegetation Survey will be established to create a new suitable habitat model.

- Similar techniques will be used to quantify existing murrelet habitat within designated critical habitat units.

- Habitat quantities will be modeled at years 0, 10, 20, 30, 40, 50, and 100 for all alternatives. Ten-year and 100-year timeframes represent short-term and long-term impacts necessary for consultation purposes; 20-50 years represents an intermediate timeframe that will be useful for determining speed of recovery/stability.

Analytical Conclusion

- Rank of alternatives as to their ability to develop and maintain murrelet habitat, based on assessment of changes in the percentages of available murrelet habitat and patch sizes.

Data Needs

- Expert Judgment Murrelet Habitat Model – to develop murrelet habitat relationships.
- Forest Operations Inventory/Current Vegetation Survey (FOI/CVS), DEM data – to develop murrelet habitat relationships.
- Occupied murrelet sites in Oregon – to develop murrelet habitat relationships.
- Forest-capable and Habitat-capable Masks developed by Raphael et al. (in press) – to identify federal lands with potential to develop into suitable habitat.
- Critical habitat map – to identify analysis areas.
- Fifth-field watershed map – to identify analysis areas.
- Physiographic province map – to develop murrelet habitat relationships.
- Marbled Murrelet Zone and southwest Oregon murrelet zone maps – to establish range of analysis.

Data Display

- Maps to illustrate habitat distribution.
- Graphs to compare habitat levels by watershed, by alternative, and through time.

References

Moeur, M., et al. in press. Northwest Forest Plan – The First Ten Years (1994-2003): Status and Trends of Late-Successional and Old-Growth Forests. Gen. Tech. Rep. PNW-GTR-646. Portland, OR: USDA Forest Service, Pacific Northwest Research Station.

Raphael, M.G., et al. in press. Spatially-Explicit Estimates of Potential Nesting Habitat for the Marbled Murrelet. In Northwest Forest Plan – The First 10 Years (1994-2003): Status and Trend of Populations and Nesting Habitat for the Marbled Murrelet. Huff, M.H. et al. (tech. coord.). PNW-GTR-XXX. Portland, OR. USDA Forest Service, Pacific Northwest Research Station.

Analytical Question #3

What levels of potential (suitable and non-suitable) sage grouse habitat are available under each alternative?

Analytical Assumptions

- Sage grouse is a wide-ranging species that requires a variety of habitat types within the sagebrush community.

- Sage grouse habitat is comprised of sagebrush-steppe between 4,000 and 8,000 feet in elevation, having an annual precipitation of 10 to 16 inches, and topography that is rolling with slopes less than 30 percent (Call and Maser 1985, as cited in Hagen in prep).
- There is currently no occupied sage grouse habitat within the analysis area.
- Current habitat conditions will not support sage grouse populations long term.
- Breeding habitat (lek), brood rearing habitat, nesting and severe winter habitat are ecologically important to sage grouse life history requirements (Hagen in prep).
- BLM Technical Manual 417 (2005) defines five classes of big sagebrush:
  1. No sagebrush (canopy) cover
  2. Trace to 5 percent sagebrush cover
  3. Greater than 5 to 15 percent sagebrush cover
  4. Greater than 15 to 25 percent sagebrush cover
  5. Greater than 25 percent sagebrush cover

  - o Sagebrush classes 3, 4, and 5 are ecologically important to sage grouse life history requirements (Hagen in prep):
  - o Class 3 is important for brood rearing.
  - o Class 4 and 5 is important for nesting/severe winter habitat.
- Lek sites may include: landing strips, old lake beds or playas, low sagebrush flats; openings on the ridge, roads, cropland, and burn areas (Connelly et al. 1981, Gates 1985 as cited in Hagen)

Analytical Methods and Techniques

- Quantify potential habitat using Ecological Site Inventory, Forest Operations Inventory, lakes, and hydrology coverage.
- The conservation strategy for sage grouse in Oregon states that 70 percent of the sage grouse range should be managed for sagebrush (Hagen, in prep). Seventy percent will be used as a standard to compare alternatives.
- Habitat quantities will be modeled at years 0, 10, 20, 30, 40, 50, and 100 for all alternatives. Ten-year and 100-year timeframes represent short-term and long-term impacts; 20-50 years represents an intermediate timeframe that will be useful for determining speed of recovery/stability.

Analytical Conclusions

- Relative value of each alternative at developing and maintaining sage grouse habitat, as measured by changes in the percentages of suitable habitat, disturbance, patch size, and connectivity.

Data Needs

- Sage grouse habitat map developed from combination of Ecological Site Inventory (ESI), Forest Operations Inventory (FOI), Oregon leks coverage, water coverage - to provide a baseline of vegetative data for habitat analysis.
- Fifth-field watershed - to represent unit of analysis.
- Ownership - to assist in analysis.

Data Display

- Maps to display habitat suitability indices.
- Graphs to compare habitat levels by watershed, by alternative, and through time.

Question for Scientists

- How should sagebrush growth and/or change over time be modeled?

References

Hagen, C. in prep. Greater Sage-Grouse Conservation Assessment and Strategy for Oregon: A Plan to Maintain and Enhance Populations and Habitat. Oregon Department of Fish and Wildlife, Bend, OR.

Analytical Question #4

What levels of bald eagle habitat will be available under each alternative?

Analytical Assumptions

- Bald eagle nests are located within 2 miles of large-order streams and large bodies of water in western Oregon, and within 4 miles in the eastern Cascades.

- Bald eagle nests are located in dominant and co-dominant canopy trees (Anthony and Isaacs 1989).

- The quality of bald eagle foraging habitat is inversely related to distance to nearest point of human disturbance (Anthony et al. 1982).

- Habitat suitability is based on two parts: (1) aquatic foraging habitat, and (2) nesting/roosting habitat.

- The habitat suitability relationship will not change over time; the relationship, once established, will be used throughout the analysis to compare the amount of habitat available under differing alternatives and at differing times into the future.

- The role of private lands in contributing bald eagle habitat will be assumed to remain constant throughout the analysis period. Current Oregon Forest Practice Rules and Statutes require protection of all known bald eagle nests, roost areas, and foraging perches.

Assessment Methods and Techniques

- The Umpqua Land Exchange Project developed a Habitat Suitability Index (HSI) model based on the quality of foraging habitat and nesting/roosting habitat (Vesely et al. 2001).

  The basic Habitat Suitability Index model is:

  $eagleHSI_f = (FHI_f * 0.4) + (NHI_f * 0.6)$

  FHI_f = foraging habitat subindex

  NHI_f = nesting habitat subindex

- Habitat Suitability Index scores will be calculated for all BLM forest capable habitats.

- Habitat indices will be grouped and quantities modeled at years 0, 10, 50, and 100 for all alternatives. Ten-year and 100-year timeframes represent short-term and long-term impacts; 50 years represents an intermediate timeframe that will be useful for determining speed of recovery/stability.

Analytical Conclusions

- Ranking of alternatives relative to their ability to create/maintain bald eagle habitat.

Data Needs

- Forest Operations Inventory/Current Vegetative Survey (FOI/CVS) data – vegetative data for Habitat Suitability Index input.
- Hydrologic data (streams and ponds/lakes) – aquatic habitat data for Habitat Suitability Index input.
- Physiographic provinces – may be necessary to develop a different Habitat Suitability Index for each physiographic province.
- Human disturbance locations (such as boat ramps and campgrounds) – data input in aquatic habitat calculations.
- Fifth-field watersheds – Habitat Suitability Index analysis units.

Data Display

- Maps to display habitat and Habitat Suitability Index scores.
- Bar graphs to compare habitat levels and Habitat Suitability Index scores across alternatives and through time.

Question for Scientists

- Are habitat assumptions in the Umpqua Land Exchange Project valid for the entire planning area, or does the model need to be adapted to each physiographic province?

References

Anthony, R.G. and F.B. Isaacs. 1989. Characteristics of bald eagle nest sties in Oregon. Journal of Wildlife Management 53:148-159.

Anthony, R.G. et al. 1982. Habitat use by nesting and roosting bald eagles in the Pacific Northwest. In: 47th North American Wildlife and Natural Resources Conferences Transactions, WMI.

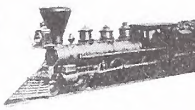
Vesely, D.G., et al. 2001. Chapter 4 – Wildlife and Coarse-Filter Biodiversity Assessment. In: Umpqua Land Exchange Project Multi-Resource Land Allocation Model Handbook.

Analytical Question #5

How do the alternatives affect the levels of special status species wildlife habitat?

Analytical Assumptions

- The current and future conditions of wildlife species will be assessed based on the wildlife habitats they utilize.
- Wildlife Habitat = wildlife cover type + structural condition + habitat elements (O'Neil et al. 2001a).
- Cover types, structural conditions, and habitat elements will be used to define like groups of BLM special status species.
- Natural special habitat (see list below) will be managed to maintain their desired ecological function
  - Seeps
  - Springs
  - Mineral licks



Wetlands
Natural meadows
Rock outcrops
Natural ponds
Caves
Oak savannah
Cliffs
Talus outcrops
Sand dunes
Vernal pools

- Human-made special habitats (see list below) will be managed as special habitats when compatible with their desired function:

  Bridges
  Buildings
  Quarries
  Pump chance/heliponds
  Abandoned mines
  Reservoirs

- The effects of the alternatives on the following special status species will not differ due to their limited distribution or association with special habitats:

  Snowy plover
  Rhinoceros auklet
  Trumpeter Swan
  Tufted puffin
  Fork-tailed storm petrel
  American white pelican
  California brown pelican
  Cassin's auklet
  Tule goose
  Aleutian Canada goose
  Dusky Canada goose
  Yellow rail
  Blue whale
  Red-necked grebe
  Silverspot butterfly
  Fender's blue butterfly
  Mardon skipper
  Vernal pool fairy shrimp
  Gray whale
  Humpback whale
  Steller's sea lion

- The use of representative species to track changes to habitat values will be applicable to the habitat requirements of all species within that group.

Assessment Methods and Techniques

- Utilizing cover type, structural conditions, and habitat element relationships from O'Neil et al. (2001b), the BLM special status species will be grouped into associations and representative species identified.

- Using techniques similar to Raphael et al. (2001) and Wales and Suring (2004), Bayesian Belief Networks will be utilized to develop watershed indices.

- Habitat quantities will be modeled at years 0, 10, 50, and 100 for all alternatives. Ten-year and 100-year timeframes represent short-term and long-term impacts; 50 years represents an intermediate timeframe that will be useful for determining speed of recovery/stability.

Analytical Conclusions

- Ranking of alternatives relative to maintaining habitat for representative species.

Data Needs

- Forest Operations Inventory (FOI)/Current Vegetation Survey (CVS) – units of habitat
- Fifth-field watersheds – units of analysis
- Plant series map – units of habitat
- Hydrology data – units of habitat

Data Display

- Maps to display habitat suitability indices.
- Graphs to compare habitat levels by watershed, by alternative, and through time.

References

O'Neil, T.A., et al. 2001a. Structural Conditions and Habitat Elements of Oregon and Washington. Pages 115-139 In: Wildlife-Habitat Relationships in Oregon and Washington. Johnson, D.H. and T.A. O'Neil (Managing Directors). Oregon State University Press. Corvallis, OR.

O'Neil, T.A., et al. 2001b. Matrixes for Wildlife-Habitat Relationship in Oregon and Washington. Northwest Habitat Institute. In D. H. Johnson and T. A. O'Neil (Manag. Dirs.) Wildlife-Habitat Relationships in Oregon and Washington. Oregon State University Press, Corvallis, OR.

Raphael, M.G., et al. 2001. Status and trends of habitats of terrestrial vertebrates in relation to land management in the interior Columbia river basin. Forest Ecology and Management 153(2001):63-68.

Wales, B. C. and L.H. Suring. 2004. Chapter 5: Assessment techniques for terrestrial vertebrates of Conservation Concern. Pages 64-72 in: Hayes, J.L., A.A. Alger, and R.J. Barbour. Tech. eds. Methods for integrating modeling of landscape change: Interior Northwest Landscape Analysis System. Gen. Tech. Rep. PNW-GTR-610. Portland, OR. U.S. Forest Service, Pacific Northwest Research Station.

Analytical Question #6

What levels of neotropical bird habitat will be available under each alternative?

Analytical Assumptions

- The current and future conditions of neotropical species will be assessed based upon the habitats that they utilize.
- Managing for ecosystems "is more desirable than one that emphasized individual species" (Altman 2000b).
- Conservation strategies will be used to identify habitat groups for analysis (Altman 2000 a,b,c).

Assessment Methods and Techniques

- The conservations strategies for landbirds developed for the Oregon-Washington

Partners in Flight, for the lowlands and valleys of western Oregon (Altman 2000a), coniferous forests of western Oregon (Altman 2000b), and east-slope of the Cascade Mountains in Oregon (Altman, B. 2000c) identify forest conditions and habitat attributes that they believe are important to support the overall goal of landbird conservation.

- Lowlands and Valleys of Western Oregon (Altman 2000a):

Habitat	Attributes
Grassland-Savanna	large patches
Grassland-Savanna	short grass - bare ground
Grassland-Savanna	moderate-tall grass
Grassland-Savanna	burrows
Grassland-Savanna	scattered shrubs
Grassland-Savanna	wet prairie/grassland
Grassland-Savanna	large oaks - cavities
Grassland-Savanna	large conifer trees
Oak Woodland	large patches, large oaks
Oak Woodland	large oaks - cavities
Oak Woodland	canopy edges and openings
Oak Woodland	young (subcanopy) oaks
Oak Woodland	herbaceous cover
Oak Woodland	native shrub understory
Riparian - Open Water	snags
Riparian Shrub	dense shrub layer
Riparian Woodland	large canopy trees
Riparian Woodland	subcanopy, tall shrub foliage
Riparian Woodland	dense shrub understory
Riparian Woodland	snags
Riparian Woodland	large, structurally diverse patches

- Coniferous Forest of Western Oregon (Altman 2000b):

Habitat	Attributes
Old-growth	Large snags
Old-growth/Mature	Large trees
Old-growth/Mature	Conifer trees
Mature	Large snags
Mature	Mid-story tree layers
Mature/Young	Closed canopy
Mature/Young	Deciduous canopy trees
Mature/Young	Open Mid-story
Mature/Young	Deciduous understory
Mature/Young	Forest floor complexity
Young/Pole	Deciduous canopy trees
Pole	Deciduous subcanopy/understory
Early-seral	Residual canopy trees
Early-seral	Snags
Early-seral	Deciduous vegetation

- East slope of the Cascade Mountains in Oregon (Altman, B. 2000c):

Habitat	Attributes
Ponderosa Pine	old forest-large patches
Ponderosa Pine	large trees
Ponderosa Pine	open understory - regeneration

Ponderosa Pine	burned old forest
Mixed Conifer	large trees
Mixed Conifer	large snags
Mixed Conifer	grassy openings, dense thickets
Mixed Conifer	multi-layered, structural diverse
Mixed Conifer	fire edges and openings
Oak-Pine Woodland	early seral, dense understory
Oak-Pine Woodland	large oaks with cavities
Oak-Pine Woodland	large pine trees/snags
Lodgepole Pine	mature/old-growth
Montane Meadows	wet and dry
Aspen	large trees/snags, regeneration
Subalpine Fir	patchy presence

- These habitat and attribute combinations will be compared to available data, and only those habitat-attribute combinations with sufficient available data will be analyzed.

- Altman (2000a, b, c) identify biological objectives for each habitat/attribute combination, which will be utilized to assess if neotropical bird habitat is increasing, decreasing or remaining static relative to the objectives.

- Habitat quantities will be modeled at years 0, 10, 20, 30, 40, 50, and 100 for all alternatives. Ten-year and 100-year timeframes represent short-term and long-term impacts; 50 years represents an intermediate timeframe that will be useful for determining speed of recovery/stability.

Analytical Conclusions

- Alternatives will be compared relative to the available level of habitat for neotropical birds.

Data Needs

- Forest Operations Inventory (FOI)/Current Vegetation Survey (CVS) – units of habitat, attributes
- Fifth-Field watersheds – units of analysis
- Hydrology data – units of habitat
- Plant Series Map – to assist in defining habitats

Data Display

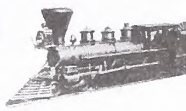
- Maps to display habitat suitability indices.
- Graphs to compare habitat levels by watershed, by alternative and through time.

References

Altman, B. 2000a. Conservation Strategy for Landbirds in coniferous Forests of Western Oregon and Washington. Oregon-Washington Partners In Flight. Boring, OR.

_____. 2000b. Conservation Strategy for Landbirds in Lowlands and Valleys of Western Oregon and Washington. Oregon-Washington Partners In Flight. Boring, OR

_____. 2000c. Conservation Strategy for Landbirds of the East-Slope of the Cascade Mountains in Oregon and Washington. Oregon-Washington Partners In Flight. Corvallis, OR.



Analytical Question 7

What levels of elk habitat will be available under each alternative?

Analytical Assumptions

- Elk habitat quality will be evaluated based on the interactions of four variables: (1) sizing and spacing of forage and cover, (2) road density, (3) cover quality, and (4) forage quality (Wisdom et al. 1986).

- There are three different classes of cover (Wisdom et al. 1986):
  - *Optimal cover* = Multi-canopied; dominant tree diameter 21 inches; canopy closure 70 percent.
  - *Thermal cover* = Stand 40 feet in height; canopy closure 70 percent.
  - *Hiding cover* = Stand capable of hiding 90 percent of a standing adult elk at 200 feet.

- Forage areas are defined as vegetated areas with less than 60 percent canopy closure (trees and tall shrubs, 7 feet in height).

- Winter range may be critical in some areas.

Assessment Methods and Techniques

- Wisdom et al. (1986) developed a habitat effectiveness model based upon the following four variables:

  HE_S = habitat effectiveness index derived from sizing and spacing of forage and cover areas.

  HE_R = habitat effectiveness index derived from the density of roads open to vehicular traffic.

  HE_C = habitat effectiveness index derived from the equality of cover

  HE_F = habitat effectiveness index derived from the quality of forage.

  $$Elk\ HE = (HE_S * HE_R * HE_C * HE_F)^{1/N}$$

- The elk Habitat Effectiveness model will be run by fifth-field analysis area.

- The Habitat Effectiveness model will also be run within defined winter ranges.

- Viable and better watersheds will have a Habitat Effectiveness score of 0.4.

Analytical Conclusions

- Comparison of alternatives, by fifth-field watershed, as to whether elk habitat is increasing, decreasing, or is stable.

Data Needs

- Forest Operations Inventory (FOI)/Current Vegetation Survey (CVS) – to calculate model variables.
- Road data – to calculate model variables.
- Ownership – unit of analysis.
- Fifth-field watershed – unit of analysis
- Winter range map – unit of analysis

Data Display

- Maps to display habitat effectiveness scores.
- Graphs to compare habitat levels by watershed, by alternative and through time.

Question for Scientists

- Is there a need for differing Habitat Effectiveness models for winter/summer range with migratory elk herds?

References

Wisdom, M.J., et al. 1986. A model to evaluate elk habitat in western Oregon. R6-F&WL-216-1986. USDA Forest Service. Portland, OR.

Analytical Question #8

What levels of fisher habitat will be available under each alternative?

Analytical Assumptions

- The current and future conditions of fisher can be assessed based on the habitats they utilize.
- Suitable breeding habitat is undefined at this time.
- Suitable foraging habitat is undefined at this time.
- Fisher historically occurred throughout the conifer forests of the planning area, with the exception of the higher elevations where snow depth may have hindered winter foraging.
- Fisher currently exist within the Medford District and Rogue River/Siskiyou National Forests and possibly within the Coos Bay District.

Assessment Methodology and Techniques

- Forest Operations Inventory/Current Vegetation Survey (FOI/CVS) data will be used to derive a fisher habitat layer.
- Indepth effects analysis will be conducted within a defined fisher core area, centered on the known population centers in southwest Oregon. A more general analysis will be conducted across the western Oregon plan area.

Analytical Conclusions

- Comparison of alternatives by the percentages of habitat, patch size, and connectivity for each alternative at the fifth-field scale.

Data Needs

- Forest Operations Inventory (FOI)/Current Vegetation Survey (CVS) - to describe habitat.
- Plant Series - to describe habitat
- Ownership – unit of analysis
- Fifth-field watershed – unit of analysis

Data Display

- Maps to display habitat availability.
- Graphs to compare detection levels by watershed, by alternative and through time.

Question for Scientists

- Is the fisher range in Oregon best described by the boundaries stated above?

Fisheries

Analytical Question #1

How would the amount of large trees available for delivery to stream channels in forested landscapes vary by alternative?

Analytical Assumptions

- Large wood delivery is an ecosystem process that greatly influences the ability of aquatic habitat to support fish populations in forested areas (Meehan 1991, WDNR 1995, OWEB 1999).

- Large wood delivery and accumulation in stream channels is necessary for:
  - In-channel processes: pool quality and quantity, off-channel habitat, and floodplain connectivity.
  - Cover for fish
  - Sediment storage
  - Dissipation of stream energy
  - Spawning habitat
  - Nutrient Retention

- Large wood is delivered to the stream channel from adjacent riparian areas and from riparian and upland episodic debris flows.

- Large wood recruitment from the adjacent riparian zone is a function of slope distance from the channel in relation to tree height.

- The abundance and survival of salmonids is often closely linked to the abundance of large woody debris particularly during winter, in forested landscapes. (Meehan 1991)

- One of the most important factors determining the viability of fish populations is the quantity of high quality habitat (Nickelson 2001). For this analysis, high quality aquatic habitat is defined as meeting the large wood benchmarks for western Oregon, as displayed on the following table (NMFS 1997).

Large Wood Benchmarks for Western Oregon		
Physiographic Region	**Properly Functioning**	**Not Properly Functioning**
Tyee Sandstone (Coast Range)	>50 pieces/mile	<15 pieces/mile
Klamath Province (Siskyou's East)	>25 pieces/mile	<10 pieces/mile
Klamath Province (Siskyou's West)	>40 pieces/mile	<25 pieces/mile
Cascades	>25 pieces/mile	<10 pieces/mile

- Large wood pieces are at least 24 inches in diameter and 50 feet long (NMFS 1997).

- Trees smaller than 24 inches in diameter function in first and second order stream channels to provide sediment storage, nutrient input, and pool formation in smaller streams (typically first and second order). However, the changes in the quantities of smaller wood available for stream channels is not included in the analysis since:
  - Smaller wood is transitory and large wood is still necessary to capture and store the smaller wood in larger order, fish-bearing streams.

- The greatest contribution of wood in headwater streams is providing large wood to downstream fish-bearing reaches where larger wood (greater than 24 inches) is necessary.

- The quantity of small wood needed in watersheds is not defined and difficult to determine.

- Due to the BLM's checkerboard ownership pattern within watersheds, it is assumed that young tree stands will continue to exist over time on all ownerships to provide small wood to stream channels.

- Hardwoods that recolonize following the removal of conifers near the stream channel provide a much high nutrient input to stream channels (Meehan 1991).

- Old-growth stands developed at low densities in the Coast Range (Tappiner et al. 1997) and in the Oregon Cascades and Willamette Valley (Poage 2000).

- Thinning trees (density management) can set stands on a trajectory to become old growth and speed the attainment of larger stem diameters (as reported in the Middle Umpqua River Watershed Analysis, DOI 2004).

- Riparian stands in a young vegetation structure class are assumed to have average tree diameters less than 20 inches in diameter. These stands would not be capable of providing large wood to stream channels.

- Riparian stands in a mature vegetation structure class are assumed to have average tree diameters between 20 inches and 32 inches in diameter. These stands would be capable of providing large wood to stream channels.

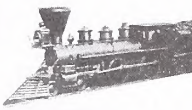
- Riparian stands in a structurally complex vegetation structure class are assumed to have average tree diameters greater than 32 inches in diameter.

- The BLM's ability to influence aquatic habitat for special status species depends on the amount and location of ownership in relation to water-bodies and high intrinsic potential stream reaches.

Special Status Fish Species Documented or Suspected to Occur on BlM-managed Lands.

*Special Status Species**	
Endangered Species Act Proposed and Listed Species	*Other*
Lower Columbia River Chinook	Millicoma Dace
Lower Columbia River Coho	Jenny Creek Redband Trout
Lower Columbia River Steelhead	Jenny Creek Sucker
Columbia River Chum	Miller Lake Lamprey
Upper Willamette River Chinook	Coastal Cutthroat Trout (Columbia River/Southwest Washington)
Upper Willamette River Steelhead	Coastal Cutthroat Trout (Upper Willamette River)
Oregon Coast Coho	Pacific Lamprey
Southern Oregon/Northern California Coho	Oregon Umpqua Chub
Bull Trout	Oregon Coast Steelhead
Lost River Sucker	Klamath River Steelhead
Shortnose Sucker	

*Special Status Species include those listed or proposed for listing under the Endangered Species Act, as well as other species (such as state-listed) that may be affected by BLM activities.



High Intrinsic Potential Model Assumptions

- Intrinsic potential for streams is defined as the stream's inherent ability to provide high quality rearing habitat for salmonids.

- Coho salmon predominate in the lowest gradient reaches (0-2%), whereas steelhead predominate in reaches with gradients of 2-3% (Burnett et al. 2003)

- Fish density decreases with increasing channel gradient beyond the optimum up to a maximum of 8% for coho salmon and 10% for steelhead.

- Reaches upstream of those with gradients exceeding 10% were not used by juvenile coho salmon, and those with gradients exceeding 15% were not used by juvenile steelhead.

Analytical Methods and Techniques

Step 1. Identify and prioritize large wood delivery source areas.

For each fifth-field watershed:

- Identify large wood delivery source areas using algorithms from the Terrain Resource Inventory and Analysis Database Model (TRIAD) (Miller 2003):

  - Use Digital Elevation Models (DEMs) and parameters to:
    - Delineate channel network.
    - Estimate channel and valley attributes (drainage area, channel gradient, channel length, mean annual precipitation, valley width, and valley side-slope gradient).
    - Estimate susceptibility to shallow colluvial landsliding based on user-specified relationships.
    - Estimate probability of debris flow to all DEM pixels, or the potential for delivery to a stream channel from all DEM pixels.

- Determine intrinsic potential for all coho, chinook, and steelhead streams within the plan area (CLAMS 2003):

  Coho Intrinsic Potential is calculated as:
  $I.P. = (MD * CG * VC)^{1/3}$

  Where:
  MD = Mean Annual Discharge
  CG = Channel Gradient
  VC = Valley Constraint

  And:
  High (>.8)
  Medium (.5-.8)
  Low (<.5)

  For all other species, treat designated critical habitat or occupied habitat for proposed or listed fish species as high intrinsic potential streams.

- Create map with existing roads, streams, fish distribution by species (from table above), high intrinsic potential stream reaches, and large wood delivery source areas.

- Prioritize large wood delivery source areas using the following rule-set:
  High: Could deliver to stream reach that has High Intrinsic Potential.

Medium: Could deliver to fish-bearing stream channel that does not have High Intrinsic Potential; blocked by road or barrier from delivering to stream reach that has High Intrinsic Potential.

Low: Delivery to non fish-bearing stream; blocked from delivering to fish-bearing stream by road or other barrier.

Step 2. Watershed Filter: Identify watersheds where BLM has the greatest ability to influence aquatic habitat.

For each fifth-field watershed:

- Calculate fish-bearing stream miles and the percent of large wood source areas on BLM-managed lands.
- Rank as high or low based on the criteria in the following table.

Criteria for Ranking Ability to Influence Aquatic Habitat		
	High	*Low*
BLM Accessible Fish-Bearing Stream Miles	>15*	<15
and/or		
% of Large Woody Debris High/Med Priority Source Areas	>25	<25
Note: 15 Stream Miles is based on the assumption from Nichelson, 2001 that if the BLM is located along at least 15 miles of accessible fish- bearing habitat there would be a greater ability to influence fish populations.		

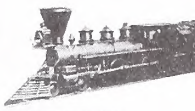
Step 3. Project structure class by alternative over time.

For each fifth-field watershed:

- Use Interagency Vegetation Mapping Project (IVMP) data and ORGANON to project the percent of each structure classes in large wood source areas on BLM ownership at 10 years, 100 years, and 200 years following treatment, for each alternative, by plant series. (Note: Ten years is considered "short term," and 200 years is considered "long term" in the Northwest Forest Plan.)

Western Hemlock and Tan Oak			
	% Structure Class in LWD Source Areas		
Structure Class	**10 yrs**	**100 yrs**	**200 yrs**
Stand Establishment			
Young			
Mature			
Structurally Complex			

Pine			
	% Structure Class in LWD Source Areas		
Structure Class	**10 yrs**	**100 yrs**	**200 yrs**
Stand Establishment			
Young			
Mature			
Structurally Complex			



Douglas-fir			
	% Structure Class in LWD Source Areas		
Structure Class	10 yrs	100 yrs	200 yrs
Stand Establishment			
Young			
Mature			
Structurally Complex			

Step 4. Project the wood budget.

For each fifth-field watershed:

- Determine wood budget within stream channels at 10, 100, and 200 years using the Reeves/Benda wood budget process. (*Pacific Northwest Interagency scientists are developing a process to determine wood budget available for stream channels. The following is a broad outline of the process. A detailed final process will be available in February 2006.)*
  - Input percent structure class within large wood delivery source areas from Step 3 into wood budget model.
  - Determine the amount of large trees available within source areas.
  - Use a large wood delivery run-out model to determine where source areas would be delivered to stream channels.
  - Use mortality and delivery rates *(will be determined in process or is being developed)* to determine frequency of large wood delivery to stream channels.
  - Apply harvest prescriptions by alternative to model for determining wood budget available within stream channels at 10 years, 100 years, and 200 years.

Step 5. Determine the wood budget from active instream restoration for each alternative.

For each fifth-field watershed:

- Calculate and display miles of high intrinsic potential habitat on BLM-managed lands.
- Overlay aquatic habitat inventory data from the Oregon Department of Fish and Wildlife to determine the number of large wood pieces per mile for high intrinsic potential habitat on BLM-managed lands.
- Using the wood budget results from the Reeves/Benda model (*in development*); project the amount of large wood available under each alternative at 10, 100 and 200 years, and overlay with data about high intrinsic potential streams on BLM-managed lands.
- For each alternative, determine number of miles of high intrinsic potential habitat that would not function properly for large woody debris.
- For each alternative, determine number of miles of high intrinsic potential habitat on BLM-managed lands that would be treated with large wood.

Step 6. Score each alternative by outcome.

For each fifth-field watershed:

- Using wood budget from wood budget model and from active restoration, score wood budget by alternative according to large wood benchmarks (from Step 1) at 10 years, 100 years, and 200 years.
  - Properly Functioning (5 points) – Wood budget meets properly functioning benchmark.
  - Not Properly Functioning (1 point) - Wood budget does not meet properly functioning benchmark.

- Add wood budget score to source area priority as defined under Step 1:
  - High Priority (5 points)
  - Medium (3 points)
  - Low (1 point)

- Add wood budget score to watershed influence score as defined in Step 2:
  - High (5 points)
  - Low (1 point)

Analytical Conclusion

Ranking of alternatives according to high, medium, and low amounts of large trees available for delivery to stream channels (see below):

- **Outcome A (High) 11-15 points:** The amount of large trees available in stream channels would be adequate in the short and long term.

- **Outcome B (Medium) 7-9 points:** *This outcome will be defined after the wood budget process is available if needed.*

- **Outcome C (Low) 3-5 points:** The amount of large trees available in stream channels would not be adequate in the short or long term.

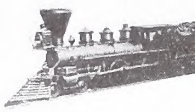
Data Display

- Table format, structured as example table below:

Number of Watersheds By Outcome of Total Watersheds in Plan Area				
	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Outcome A (High)	25/40	40/40	1/40	35/40
Outcome B (Med)	5/40	0	15/40	2/40
Outcome C (Low)	10/40	0	24/40	3/40

Data Needs

- Ownership, by watershed
- Stream miles, by ownership
- Fish distribution
- Large wood delivery source vegetation data
- Projections of riparian stand structure in 10-year, 100- and 200-year increments
- 10-meter Digital Elevation Models
- Valley Width Index (derived from relationship between channel form and valley width), gradient, and stream discharge for high intrinsic potential model
- Habitat inventory data, about large wood, from the Oregon Department of Fish and Wildlife.



Analytical Question # 2

How will changes to stream temperature affect fish under each alternative?

Analytical Assumptions

- Salmonids are a beneficial use and their needs are included in water quality temperature standards.
- If water quality temperature standards are not met, an increase in stream temperature could harm fish.
- Water temperatures affect the biological cycles of aquatic species and are a critical factor in maintaining and restoring healthy salmonid populations. See the following table for temperature standards for species within the plan area (ODEQ 2004)

Temperature Standards for Species Within the Western Oregon Plan Revisions Area	
Species	*Seven-Day-Average Maximum Temperature Standard (degrees Fahrenheit)*
Salmon and steelhead	55.4
Salmon and trout rearing and migration	64.4
Lahontan cutthroat trout or Redband trout	68.0
Bull trout spawning and juvenile rearing	53.6

Analytical Methods and Techniques

Step 1. Overlay fish distribution with stream shade analysis.

For each fifth- field watershed:

- Use Geographical Information Systems (GIS) to overlay fish distribution with results from stream shade analysis.

Analytical Conclusions

Ranking of alternatives displaying how each alternative meets shade targets, for each fifth-field watershed:

- Outcome for each fish species by alternative.
- Outcome A: Alternative meets shade targets.
- Outcome B: Alternative would not meet shade targets.

Data Display

- Table display of data, using the example table format below.

Number of Watersheds By Outcome of Total Watersheds in Plan Area				
	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Salmon and Steelhead				
Outcome A	40/40	0	40/40	40/40
Outcome B	0	40/40	0	0
Salmon and Trout Rearing and Migration				
Outcome A	40/40	0	40/40	40/40
Outcome B	0	40/40	0	0
Lohontan Trout/Redband Trout				
Outcome A	40/40	0	40/40	40/40
Outcome B	0	40/40	0	0
Bull Trout Spawning and Juvenile Rearing				
Outcome A	40/40	0	40/40	40/40
Outcome B	0	40/40	0	0

Data Needs

- Fish distribution

Analytical Question #3

How will changes in peak flows within stream channels affect fish under each alternative?

Analytical Assumptions

- Channel forming flow is a series of naturally occurring discharges that result in channel morphology close to the existing channel.

- Extreme flood flows can cause large-scale effects on channel morphology and fish habitat. The runoff volume from these storms can overwhelm the hydrologic effects of vegetation management and roads (Harr 1981).

- More frequently occurring flows, such as those with a 1.5-year to 2-year return interval, are generally the dominant channel forming flows in stable natural streams (Schueler 1987 and Rosgen 1996). For steep mountain streams and for this analysis, the 2-year, 24-hour peak flow is used to simulate a channel forming flow (Lisle 1981). Water available for runoff in rain-on-snow areas is estimated as an incremental change compared to this reference flow.

- When 5-year, 24-hour flows (10%-20% above 2-year 24-hour flow) begin to occur at the 2-year, 24-hour frequency, stream channels can become unstable, effect channel morphology and increase streambank erosion (Harr 1992).

Analytical Methods and Techniques

Step 1. Determine percentage increase of peak flow by alternative.

For each sixth-field:

- Use output from Hydrology peak flow analysis to determine if peak flows would increase in frequency from a 2-year 24-hour flow, to a 5-year 24-hour flow.

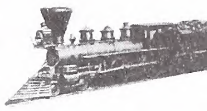
Analytical Conclusions

Ranking of alternatives showing increase/decrease of peak flow changes, by fifth-field watersheds, for each fish species by alternative:

- Outcome A: Peak flow frequency does not increase from a 2-year 24-hour flow, to a 5-year 24-hour flow as a result of management actions.

- Outcome B: Alternative causes peak flow frequency to increase from a 2-year 24-hour flow, to a 5-year 24-hour flow as a result of management actions.

Number of Watersheds By Outcome of Total Watersheds in Plan Area				
	Alternative 1	**Alternative 2**	**Alternative 3**	**Alternative 4**
Outcome A (no peak flow increase)	40/40	0	40/40	40/40
Outcome B (peak flow increase)	0	40/40	0	0



Analytical Question #4

How will changes in sediment delivery to stream channels affect fish under each alternative?

Analytical Assumptions

- Salmonids have the ability to cope with some level of sediment at various life stages.
- In gravel-bed streams, persistent infiltration of fine sediment into gravel reduces survival of salmonid eggs and fry (Hall and Lantz 1969, Everest et al. 1987, Sullivan et al. 1987).
- High concentrations of suspended sediments reduces survival of adult and juvenile fish, and aquatic invertebrates (Newcombe and MacDonald 1991).
- McHenry et al. (1994) found that excessive fines (> 13% of sediments <0.85 mm) resulted in inter-gravel mortality for coho salmon and steelhead trout embryos because of oxygen stress.
- Once sediment enters the channel, downstream routing and effects on fish habitat are determined by channel morphology, quantity and size of sediment, and frequency and magnitude of flow events (Swanston 1991).
- Predicting sediment delivery to streams is difficult due to both the extreme variability in site conditions and in the variables leading to accelerated erosion. It is difficult to quantify or accurately predict the indirect effects sediment delivery will have on fish habitat (such as sedimentation of gravel interstices, channel aggradation and widening, and increased suspended sediment load).

Analytical Methods and Techniques

Step 1. Determine increase in sediment to stream channels by alternative . For each 5th field watershed, use results from sediment analysis and interpret narratively to assess impacts to fish.

Analytical Conclusions

Ranking of alternatives, showing changes in sediment delivery. For each 5th field watershed, outcome will be displayed on a table as formatted below for each fish species by alternative:

- *Outcome A*: Changes in sediment delivery to stream channels would not affect fish or fish habitat.
- *Outcome B*: Changes in sediment delivery to stream channels would affect fish or fish habitat.

Number of Watersheds By Outcome of Total Watersheds in Plan Area				
	Alternative 1	**Alternative 2**	**Alternative 3**	**Alternative 4**
Outcome A (sediment delivery would not affect fish)	40/40	0	40/40	40/40
Outcome B (sediment delivery would affect fish)	0	40/40	0	0

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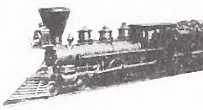

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Hydrology

Water Quantity

Analytical Question # 1

How do the alternatives affect water available for runoff and peak flow estimates within rain-on-snow elevations?

Analytical Assumptions

- Rain-on-snow areas where shallow snow accumulations can come and go have been reported by Harr (1981, 1992) to be in the elevation range of 1200-3600 feet in western Oregon.

- Regeneration harvests or forest conversions will provide additional melt contributions under rain-on-snow conditions (Harr 1981, Storck 1997).

- Rain-on-snow occurrences normally correspond with a streamflow return period of 2 to 8 to years where pre-logging and post-logging regressions were significantly different (Harr 1992).

- Forest openings commonly receive greater snow accumulation (2 to 3 times more snow water equivalent) than adjacent forests (Harr 1992). These openings also receive greater wind speeds and twice the amount of heat during rain-on-snow events, which provides greater melt compared to the mature forest (Harr 1981, 1992; Storck 1997).

- U.S. Army Corps of Engineers (USACE)(1956, 1998) show that the principal melt component in a rain-on-snow event is convection/condensation melt. This component is far larger than long-wave and short-wave radiation melt, rain melt, and ground melt. In a typical USACE rain-on-snow example, convection/condensation melt accounts for 70 percent of daily snowmelt quantities. Wind speed near the ground, as well as warm air temperatures and dewpoint temperature near air temperature, are the drivers in the convection/condensation melt term.

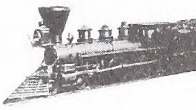
- Basin characteristics regression analysis with gauged watersheds of long-term record is an appropriate method of describing peak flows of various exceedance probabilities for unregulated streams in ungauged watersheds. Harris and Hubbard (1979) flood frequency equations were chosen as reference points, because they cover the various hydrologic regions in the plan area and have long-term record. Routing of snowmelt available for runoff with these equations adds a margin of safety, because the data set may include some rain-on-snow events.

- The 2-year, 24-hour precipitation intensity is assumed to coincide with the 2-year, 24-hour discharge.

- The subwatershed level (USGS Sixth Hydrologic Unit Code field) was chosen for the analysis, because it better approximates the BLM forest land pattern, and tributary streams are more sensitive to vegetation and runoff-related changes. This analysis level can also be viewed as an additional margin of safety in terms of describing effects.

Analytical Methodology and Technique

The following analytical technique is an empirical approach patterned in part from the Washington State Department of Natural Resources' Hydrologic Change Module (v. 4.0), 1997.



Step 1 - Construct "Flood-Frequency Precipitation" data layer. Obtain precipitation frequency data for the 2-year 24-hour storm for the plan area in raster format (NOAA 1973).

Step 2 -Intersect Watershed Boundaries with "Flood-Frequency Precipitation" data. Intersect the BLM watershed data theme with the flood-frequency precipitation derived data layer at the sixth-field HUC level.

Step 3 - Calculate 2-Year 24-Hour Streamflow, and the 5-Year 24-Hour Streamflow. District hydrologists will compute stream flow for the 2-year 24-hour storm for all sixth-field watersheds wholly or partly contained in the plan area, based on USGS basin characteristics regression analysis method (Harris and Hubbard 1979) and precipitation frequency data (NOAA 1973) obtained in Steps 1 and 2 above.

Coast Region: $Q_{0.5}=4.59A^{0.96}(ST+1)^{-0.45}I^{1.91}$

Willamette Region: $Q_{0.5}=8.70A^{0.87}I^{1.71}$

Rogue-Umpqua Region: $Q_{0.5}=24.2A^{0.86}(ST+1)^{-1.16}I^{1.15}$

High Cascades: $Q_{0.5}=4.75A^{0.90}(ST+1)^{-0.62}(101-F)^{0.11}I^{1.17}$

where:
$Q^{0.5}$= discharge in cubic feet per second (CFS) for a 2-year 24-hour recurrence interval event:
A = drainage area in square miles
ST = area of lakes and ponds in percent
F = forest cover in percent
I = 2-year 24-hour precipitation intensity in inches

District hydrologists calculate the 5-year 24-hour storm by use of the following equations (Harris and Hubbard 1979)

Coast Region: $Q_{0.2}=6.27A^{0.95}(ST+1)^{-0.45}I^{1.95}$

Willamette Region: $Q_{0.2}=15.6A^{0.88}I^{1.55}$

Rogue-Umpqua Region: $Q_{0.2}=36A^{0.88}(ST+1)^{-1.25}I^{1.15}$

High Cascades: $Q_{0.2}=8.36A^{0.86}(ST+1)^{-0.81}(101-F)^{0.08}I^{1.30}$

where:

$Q^{0.2}$= discharge in cubic feet per second (CFS) for a 5-year 24-hour recurrence interval event,
A = drainage area in square miles
ST = area of lakes and ponds in percent
F = forest cover in percent
I = 2-year 24-hour precipitation intensity in inches

Step 4 - Determine "Dominant Winter Precipitation Type." The derived data layer will include elevation bands of rain-dominated areas that are below the rain-on-snow zone; and rain-on-snow zone and snow-dominated zone that are above the rain-on snow zone. District hydrologists will assign lower and upper elevation bounds for the rain-on-snow

zone for all fifth- and sixth-field watersheds wholly or partly contained in the plan area, based on the following criteria:

Lower Bounds of the Rain-On-Snow Zone
Use National Resources Conservation Service SNOWTEL data for January 1 snow accumulation elevation (feet) (Greenburg and Welch 1998)

Upper Bounds of the Rain-On-Snow Zone
Use regionally established upper limit from hydrologist observation or literature or the start of frozen soils, which may vary from 3600-5000 feet.

or Alternative Approach:
Oregon State University or USFS Pacific Range and Experiment Stations scientists will construct the derived data layer.

Step 5 - Sort the "Dominant Winter Precipitation Type" data layer. Sort by sixth-field watershed, and mask (exclude) any subwatersheds that do not contain rain-on-snow polygons.

Step 6 - Determine "Current Condition Hydrologic Maturity." Use the 1996 classified Interagency Vegetation Mapping Project TM (IVMP) imagery. The reclass table should use the land cover crown closure classes specified in the table below to construct the derived data layer.

Description of Land Cover Classes by Hydrologic Maturity

Hydrologic Maturity	Land Cover Classes
Hydrologically Mature	>70% total crown closure AND <75% of the crown in hardwoods or shrubs
Intermediate Hydrologic Maturity	10%-70% total crown closure AND <75% of the crown in hardwoods or shrubs
Minimum Hydrologic Maturity	<10% total crown closure AND/OR >75% of the crown in hardwoods or shrubs
Non-Forested	Agricultural and Grazing Lands Open Water Lakes, Ponds, Reservoirs Inundated Wetlands Other naturally occurring open areas

Source: Department of Natural Resources, Hydrologic Change Module

Step 7 - Intersect "Hydrologic Maturity" with "Dominant Winter Precipitation Type." Intersect the sixth-field sub-watershed GIS-derived data layers where the rain only or snow only subwatersheds have been masked.

Step 8 - Estimate Snow Depth. Create an "Estimated Snow-water Equivalent" polygon data layer. Obtain the BLM GIS Topographic Data theme in 100-foot contour intervals for all areas where fifth-field watersheds are wholly or partly contained in the plan area.

Solve the following two equations (Greenburg and Welch 1998):

Northwest Oregon
SWE =0.009*Elevation-21.66 *R

Southwest Oregon
SWE =0.006*Elevation-19.53*R

where:
SWE = February 1 snow-water equivalent in inches.
Elevation = elevation in 100-foot increments
R = snowwater equivalent ratio to adjust for cover types

SWE values calculated are assumed to represent snow accumulation in hydrologically mature forests; these must be modified to account for variations in accumulation between different land use/cover types (see table below).

Hydrologic Maturity and Snow-water Equivalence Ratio		
	Rain-on-Snow	**Snow-water Equivalent Ratio (R)***
Hydrologically Mature	Acres	1
Intermediate Hydrologic Maturity	Acres	1.5
Minimum Hydrologic Maturity	Acres	2
Non-Forested	Acres	2
*Source: Brunengo et al. 1992.		

District hydrologists will separate the sixth-field rain-on-snow subwatersheds that represent the northwest Oregon equation from those representing the southwest Oregon equation.

Snow-water equivalent will be used with the current condition and 10-year scenarios vegetative cover classes to obtain an estimated water depth available for melt.

Solve the two equations with the snow-water equivalent ratios for the existing condition using classified IVMP data from Step 6. This is completed by intersecting the hydrologic maturity GIS-derived data layer with the estimated snow-water equivalent data layer. Multiple SWE polygons for partial areas in acres (A) within a hydrologic maturity polygon are summed as follows:

$$[(SWE^1*A^1) + (SWE^2*A^2) + (SWE^3*A^3)]/A) *R$$

The snow-water equivalent ratio value associated with the hydrologic maturity cover type is substituted into the appropriate equation. This estimated SWE is tracked in the attribute file of the current condition hydrologic maturity data layer.

Step 9 - Determine One-Day Snowmelt for the Design Storm. This procedure uses an equation from U.S. Army Corp of Engineers (1956).

$$M = T_a [0.133 + (0.086 \times v) + (0.0126 \times P_r)] + 0.23$$

where:
M = snowmelt, cm/day
v = wind velocity, meters/sec
P_r = rate of precipitation, cm./day
T_a = temperature of saturated air, at the 3-meter (10-feet) level, °C

Temperature
Storm temperature varies primarily with elevation. Determine the average storm temperature (T_a °C) for each precipitation zone based on generalized regional lapse-rate equations:

Western Oregon = 10 - (0.006 x E)

where:
E = elevation in meters

Wind speed
Local wind speed primarily depends on the vegetative cover, with mature forest canopies significantly reducing the wind speed at the interface between the snowpack and the air. Fifty percent exceedance wind speed will be used for the plan area.

For each polygon in each sixth-field watershed, modify the wind speed estimates to reflect the influence of land use/cover types, using the equation (Dunne and Leopold 1978):

$v = va\ [1 - (0.8 \times Fc)]$

where:
v = windspeed meters/second
va = 50% exceedance windspeed, meters/second
Fc = canopy closure (fractional form; 100% = 1.0).

Use the canopy closure values given for each land use cover type in Step 6.

Snowmelt
Calculate snowmelt in each hydrologic maturity polygon for the current condition using the above equation (U.S. Army Corps of Engineers 1956; Harr 1981) The hydrologic maturity-derived data layer polygons have the estimated SWE included with their attribute file. If the calculated M for a given scenario exceeds the estimated snow accumulation (SWE), set M = SWE; also, if T_a 0 C, M = 0. Convert M to inches.

Repeat for each alternative's first 10 years. Classify the proposed units into land cover classes as in Step 6. Solve for M for the 10-year scenario only.

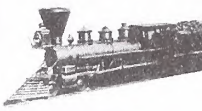
Step 10 – Calculate water available for runoff. The equation for water available for runoff (WAR) = M + 2-year 24-hour precipitation.

Calculate water available for runoff for the current condition for the rain-on-snow areas within all sixth-field watersheds partially or wholly in the plan area. Sum M for each hydrologic maturity polygon within the rain-on-snow zone + 2-year 24-hour precipitation obtained by intersecting flood frequency precipitation derived data layer in step I.

Repeat for each alternative's first 10 years. Classify the proposed units into land cover classes as in Step 6.

Step 11 – Estimate peak flow. Estimate peak flows for each sixth-field HUC unit by substituting water available for runoff values for the current condition and each alternative's for the first 10 years into the baseline streamflow regression equations.

Step 12 – Conduct sensitivity analysis. As a sensitivity analysis for the design storm, the maximum potential water available for runoff from rain-on-snow areas on BLM will be



calculated. This will assume that the entire rain-on-now area would be regeneration harvested within the first 10-year period.

As a sensitivity analysis for the design storm, one standard error of the estimate will be applied to the USACE snowmelt equation for temperature and wind speed.

Analytical Conclusions

- Rank of alternatives by sub-watersheds sensitive for estimated peak flow increase (those that exceed the 5-year 24-hour peakflow).

Data Needs

- National Oceanic and Atmospheric Administration (NOAA) 2-year 24-hour Precipitation Frequency map of Oregon. Available in GIS raster format from: <http://www.nws.noaa.gov/ohd/hdsc/noaaatlas2.htm>
- U.S. Weather Service Windspeed Frequency.
- Classified 1996 imagery from the Interagency Vegetation Mapping Project (IVMP), including new openings under 10 years of age, current to 2005.
- GIS-derived data layer of dominant winter precipitation type.
- GIS-derived data layer of elevation snow-water equivalent.
- Watershed area by sixth-field watershed.
- By alternative, GIS-derived data layer of 10-year scenario regeneration harvest units.

Data Display

- Maps showing sixth-field subwatersheds where the water available for runoff exceeds the 5-year 24-hour baseline peakflow for the current condition.

- Maps showing sixth-field subwatersheds where the water available for runoff exceeds the 5-year 24-hour baseline peakflow with the application of each alternative's first 10 years.

- Maps showing sixth-field subwatersheds where the water available for runoff on BLM is > 5% of the current condition with the application of each alternative's first 10 years.

Question for Scientists

- How does forest opening size affect snowmelt? Unit configuration within the rain-on-snow area and managed opening size may reduce snow catch and melt characteristics, thus reducing much of the rain-on-snow uncertainty of increased peak flows.

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Water Quality

Analytical Question #2

How will the alternatives affect diffuse and concentrated road sources of fine sediment delivery to stream channels?

Analytical Assumptions

This analysis is based on use of a reference road, which is similar to the procedure used by the Washington Department of Natural Resources Surface Erosion Module vs. 4.0, 1997.

The reference road will use the following assumptions: An in-sloped road with a ditch; native surface road tread and ditch; general use traffic (mostly pick-ups and sedans); cut-slope gradient 1:1 (horizontal to vertical) and fill-slope gradient 1.5:1; initial ground cover density of zero on cut and fill slopes; sustained grade of 5-7 percent; and an average cross-drain spacing of 500 feet.

Proportions of the total long-term average road erosion rates attributed to the components of the standard road prism (Swift 1984, Burroughs and King 1989, Sullivan and Duncan 1980, Megahan unpublished data) are:

- Road Tread 40%
- Cutslope and Ditch 40%
- Fillslope 20%

Roads differ in their inherent erodibility, or erosion potential, due to the geology, or parent material on which they are constructed (see table below). Sediment yields from older roads with undisturbed ditches are much smaller than sediment yields from newer roads or roads with disturbed ditches. Road maintenance of ditchlines can increase sediment yields.

Basic Erosion Rates (Note: Numbers represent erosion rates in tons/acre of road prism/ year.)			
		Road Age	
General Category	Geologic Parent Material	New 0-2 Years	Old > 2 Years
High	Mica schist Volcanic ash Highly weathered sedimentary	110	60
High/Moderate	Quartzite Course-grained granite	110	30
Moderate	Fine-grained granite Moderately weathered rock Sedimentary rocks	60	30
Low	Competent granite Basalt Metamorphic rocks Relatively unweathered rocks	20	10
Sources: Kochendorfer, J. N. and J. D. Helvey 1984; Hayden et al. 1991; Megahan and Kidd 1972; Reid and Dunne 1984; Sullivan and Duncan, U.S. Forest Service unpublished data.			

The basic erosion rate for road erodibility is decreased by vegetative cover and surface roughness on cut and fills slopes. The following table shows reduction factors from the basic erosion rate.

Groundcover Correction Factor for Cut and Fill Slopes	
Ground Cover Density Factor	Factor
>80%	0.18
50%	0.37
30%	0.53
20%	0.63
10%	0.77
0%	1.00
Sources: Megahan 1991, Burroughs and King 1989, Megahan unpublished data.	

The basic erosion rate for road erodibility is decreased by road tread surfacing. The following table shows reduction factors based on types of surfacing.

Factors for Road Tread Surfacing	
Surfacing Material Factor	Factor
Paved	0.03
Gravel, greater than 6 inches deep	0.2
Native soil/rock	1.00

The basic erosion rate for road erodibility is increased by road traffic and wet weather haul. Wet weather haul is assumed to be at elevations below 3,000 feet for 6 months each year. The following table shows erodibility increase factors based on precipitation bands and traffic level.

Traffic and Precipitation Factor			
	Annual Precipitation		
Traffic Use/Road Category	<47 inches	47 inches – 118 inches	>118 inches
Heavy Traffic/Wet Weather Haul	20	50	120
Sources: Reid and Dunne 1984; Sullivan and Duncan unpublished			

Sediment Delivery

- Sediment delivery to streams is affected by the road drainage system design including road prism shape, proximity of the road to the stream channel, and length of road draining directly into a stream at crossings.
- Sediment delivery to streams by road segment: Assume that a road segment does not deliver if the road does not cross a stream channel.
- Sediment delivery to streams by ditches. Assume 100% delivery of sediment to streams from the road prism and cutslope before application of factors.
- Sediment delivery to streams by diffuse sources. Assume 10% delivery of sediment to streams from the cutslope before application of factors.
- Best Management Practices can substantially reduce sediment delivery from roads.

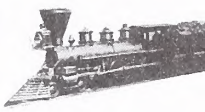
Sediment Delivery Distance

- Roads near ridges have little direct effect on sediment delivery to streams.
- Generalized distances for sediment filtration effectiveness occur much sooner (25-100 feet) for diffuse sources of sediment delivery compared to concentrated sources (200 feet), such as road ditch lines draining into the riparian area (CH2MHill 1999).
- Wemple (1998 cited in Jones et al 2000) found that road segments that have stream connection pathways such as roadside ditches have potential to deliver surface eroded sediment to streams. Road segments not connected to streams by ditch lines or gullies or have more than 25 to 100 feet of filtering forest floor duff and vegetation (depending on slope, soil properties, and surface roughness) between them and a stream are usually not at risk of delivering sediment to streams.
- Below culverts, sediment travel distance in streams decreases with increasing roughness, such as debris and obstructions (Brake et al. 1997).
- Concentrated and diffuse sources of sediment delivery in this analysis are assumed to be within 200 feet of stream channels.

Analytical Methodology and Technique

Step 1 - The analysis is performed by fifth-field watershed within the plan area.

Step 2 - Build a basic erosion rate (BER) data layer from the BLM geology data theme for the parent materials in the Basic Erosion Rates Table (above in Analytical Assumptions) with input from the District Geologist. Assign basic erosion rates for the new roads < 2 years old and old roads >2 years from the Basic Erosion Rates Table (see above in Analytical Assumptions).



Step 3 - Build a data layer of the NWFP "Plan Flow" attribute streams from the BLM waterbodies data theme.

Step 4 - Buffer the water bodies derived data layer (Step 2) to 200 feet and make a new derived data layer.

Step 5 - Intersect and clip the BLM GTRN (roads) data theme with the data layer built in Step 4. Exclude road segments that do not cross a stream (Step 3).

Step 6 - Intersect and clip the BLM roads layer for each alternative's first 10 years with the data layer built in Step 4. Exclude road segments that do not cross a stream (Step 3).

Step 7 - Build a table of specific vegetative correction factors by fifth-field watershed (see table labeled Groundcover Corrector Factor for Cut and Fill Slopes, above in Analytical Assumptions).

Step 8 - Use the Prism Climate Model to build a derived data layer of average annual precipitation by fifth-field watershed.

Step 9 - Calculate the traffic factor in the table by the following: (1) Separate the area below 3,000 feet and create a new data layer. (2) For the BLM roads layer for each alternative's first 10 years, drop any road that accesses a forest unit having a slope of 35% or less. (3) For the remaining roads, use the Prism-derived data layer (Step 8) and classify the road segments with attributes in the three precipitation bands: <47", 47-118" and >118" (see table labeled Traffic and Precipitation Factor, above in Analytical Assumptions).

Step 10 - Calculate the road segment lengths within the roads data layer, and BLM roads layer for each alternative's first 10 years and add to the data tables. Calculate standard road cutslope width * segment length = area and add to data tables. Calculate standard road prism width * segment length = area and add to data tables. Calculate standard road tread width * segment length = area and add to data tables. Calculate fill slope width * segment length = area and add to the data tables.

Step 11 - For each road segment within the GIS buffered roads derived data layer in each fifth-field watershed:

Return basic erosion rate (BER) value from the basic erosion rate derived data layer of > two year old road age for current condition and < two year old road age for the new roads under each alternative's first 10 years.

Calculate:
(BER * 0.40 * vegetation factor) * [(cutslope width) + (road prism width - road tread width / 2)] *length/ 43560.

(BER * 0.40 * road surface type factor * (traffic factor/2) * [(road tread width) * length]/43560.

(BER * 0.20 * vegetative factor * 0.10) * [(fillslope width) + (road prism width - road tread width / 2) *length] /43560.

Sum answers to all three of the above calculations.

Analytical Conclusions

- Rank of alternatives by their effect on diffuse and concentrated road sources of fine sediment delivery to stream channels (tons/acre/year).

- Comparison of sediment delivery to that which occurs under the No Action Alternative.

Data Needs

- Proposed new road 10-year scenarios, by alternative.
- Proposed winter haul routes, by alternative.
- GIS-derived data layer of basic erosion rate.
- GIS-derived data layer of "Plan Flow" streams, as identified in the Northwest Forest Plan.
- GIS-derived data layer of buffered roads derived data layer.
- GIS-derived data layer of buffered 10-year scenario roads derived data layer for each alternative.
- Prism Model of average annual precipitation, averaged for each fifth-field watershed.

Data Display

Populate the following table:

Potential Sediment Delivery, by Alternative			
Alternative	Potential Sediment Delivery, Tons/Acre/ Year	Delivery Points, Number	Potential Average Sediment Delivery Road Stream Intersection, (Tons/Acre/Year)
No Action			
Alternative 1			
Alternative 2			
Alternative 3			
Alternative 4			

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Analytical Question # 3

How will the alternatives affect potential slope failure and channel debris flow hazards to streams from vegetative management and road construction activities?

Analytical Assumptions

- The analysis technique will be performed across all lands by fifth-field watersheds.
- Use the mass wasting hazard mapping program (Miller 2003). This program will:
  - Estimate susceptibility to shallow colluvial landsliding.
  - Estimate probability for debris flow delivery to a stream reach.

  The program uses geomorphic relationships based on the Digital Elevation Models (DEM). For shallow landsliding slope failure probabilities, DEM relationships are formed to indicate slope and topographic convergence.

  For the Oregon Coast Range, landslide density is empirically calibrated as a function of topography and vegetation. Vegetation is classed as: (1) open stands (clear cuts), (2) mixed hardwood – conifer stands and small conifer stands, (3) large conifer stands; and (4) roads (with a buffer).

  Outside of the Oregon Coast Range, landslide density has yet to be determined.
- The BLM Timber Productivity Capability Classification (TPCC) can indicate areas of slope instability, particularity codes FGR1, FGR2 and FGNW. This data theme will be used as a quality control check.
- The BLM's roads (GTRN) data theme has digitized roads on BLM, as well as the major network on other lands. On private lands, roads are underestimated by 10-30 percent, as many local roads are not shown.

Analytical Methodology and Technique

Mass Wasting Susceptibility Mapping

Step 1 - Analyze the plan area fifth-field watersheds using Miller (2003) landslide susceptibility landslide model to estimate the probability of slope failure. In the Oregon Coast Range, use topographic slope, convergence, and vegetation classes. Elsewhere, topographic slope, convergence, geology and vegetation will be used.

Soil scientists/hydrologists classify the results of the high category of potential slope failure mapping.

Step 2 - For BLM lands, intersect the Mass Wasting Susceptibility mapping with the BLM GIS TPCC data theme. Determine the agreement for the TPCC FGR1, FGR2, and FGNW codes.

Step 3 - Intersect the potential slope failure mapping with the BLM GTRN (roads) data theme. Select the road segments in the high category and calculate miles (current condition).

Step 4 - Intersect the potential slope failure mapping with the hydrologic maturity derived data layer (see peak flow planning criteria). Select regeneration harvest areas that are less than or equal to 10 years old in the high category and calculate acres (current condition).

Step 5 - Intersect the potential slope failure mapping with the 10-year roads scenario for each alternative. Select the road segments in the high category and calculate miles (changed condition under each alternative).

Step 6 - Intersect the potential slope failure mapping with the regeneration harvest scenario for each alternative. Select the regeneration harvests in the high category and calculate acres (changed condition under each alternative). Repeat at 100 years.

Channelized Debris Flow Mapping

Step 1 -Use Miller (2003) Mass Wasting Hazard Mapping Program.

Analytical Conclusions

- Rank of alternatives by the degree they affect potential slope failure and channel debris flow hazards to streams from vegetative management and road construction activities.
- Comparison of potential slope failure and channel debris flow hazards to that which occurs under the No Action Alternative.

Data Needs

- USGS Digital Elevation Model of the plan area.
- Imagery from the Interagency Vegetation Mapping Project (IVMP) - Hydrologic Maturity derived data layer.
- BLM GIS data theme for Timber Production Capability Classification (TPCC)
- Data about BLM roads - GIS data theme: Ground Transportation Network (GTRN).
- By alternative, GIS-derived data layer of 10-year scenario regeneration harvest units and roads.

Data Display

High Mass Wasting Susceptibility			
Alternative	10 Years		100 Years
	Harvest Areas (Acres)	Roads (Miles)	Harvest Areas (Acres)
No Action			
Alternative 1			
Alternative 2			
Alternative 3			
Alternative 4			

References

Dietrich, W.; Montgomery, D. 1998. Online: <http://socrates.berkeley.edu/~geomorph/shalstab/>.

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Analytical Question # 4

Will each alternative maintain effective shade along watercourses, lakes and wetlands?

Analytical Assumptions

- Maintaining streamside shade is a surrogate for meeting the Department of Environmental Quality (DEQ) temperature standard. Northwest Forest Plan Temperature Total Maximum Daily Load (TMDL) Implementation Strategies (2005) demonstrate how retention and variable retention areas meet shade goals and the DEQ temperature standard. These are described as Primary and Secondary shade zones. The derivation of these zones is based on factors including seasonality of streams, topography, forest vegetation, and solar physics.

- Only perennial streams are considered in this analysis, because of the influence that forest shade has on maintaining cool water temperatures during the summer.

- Topography can block solar radiation through parts of the day for certain stream segments.

- Forest trees near stream channels and dense stands can block solar radiation and cast shadows across the stream. Angular canopy density (ACD) is the measure of canopy closure as projected in a straight line from the stream surface to the sun, as it varies through the day. The ACD value for a given buffer depends on the spacing of forest crowns. As vegetation becomes more open through wider spacing, more width of vegetation is needed to achieve the same ACD for the similar vegetation with closer spacing. Higher ACD is achieved with lower sun angles and higher canopy density.

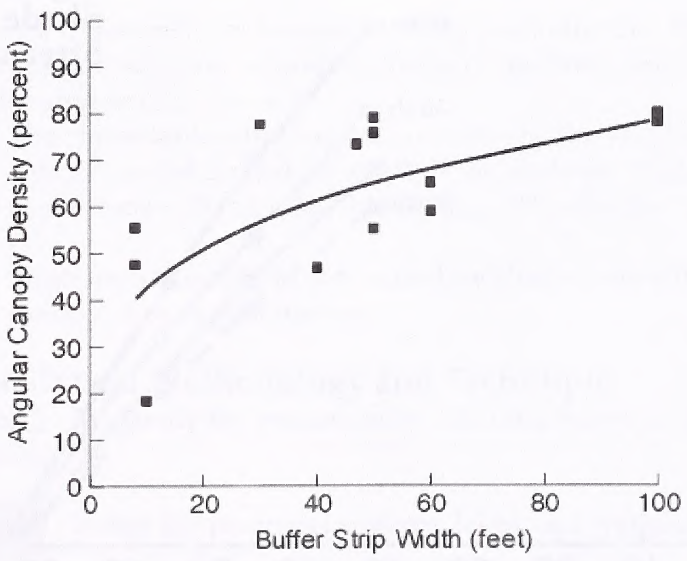

Figure A - Angular canopy density (ACD) and buffer widths for small streams in western Oregon (Brazier and Brown 1972).

Figure A above shows that a buffer strip width of 60 feet will result in an angular canopy density of 65 percent.

Effective shade is the total amount of radiant energy prevented from reaching a stream in a solar day. Because the sun path and azimuth is changing throughout the day, forest vegetation has different efficiencies in blocking radiation for different time periods. As seen in Figure D, most solar heating occurs between 10:00 a.m. and 2:00 p.m. Park (1993) has shown that the width of primary riparian streamside areas will vary as a function of tree height and terrain slope as viewed in the Primary Shade Zone Table, included below after Figure D.

The planning criteria assume that the secondary shade zone is defined as the outer edge of the primary shade zone to 100 feet. There is marginal improvement of ACD past 100 feet (Figure A). Significant temperature rises do not occur when effective shade is ≥ 80% (Figures B and C below).

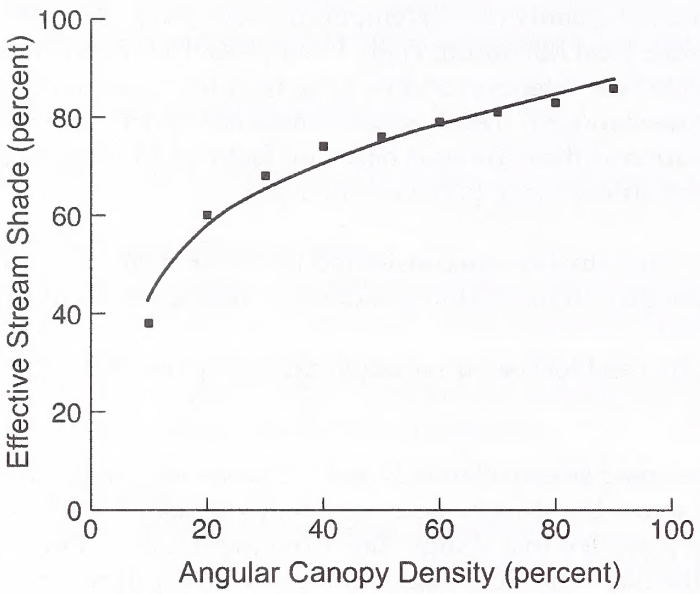

Figure B - Angular canopy density (ACD) and stream shade (Park 1991).

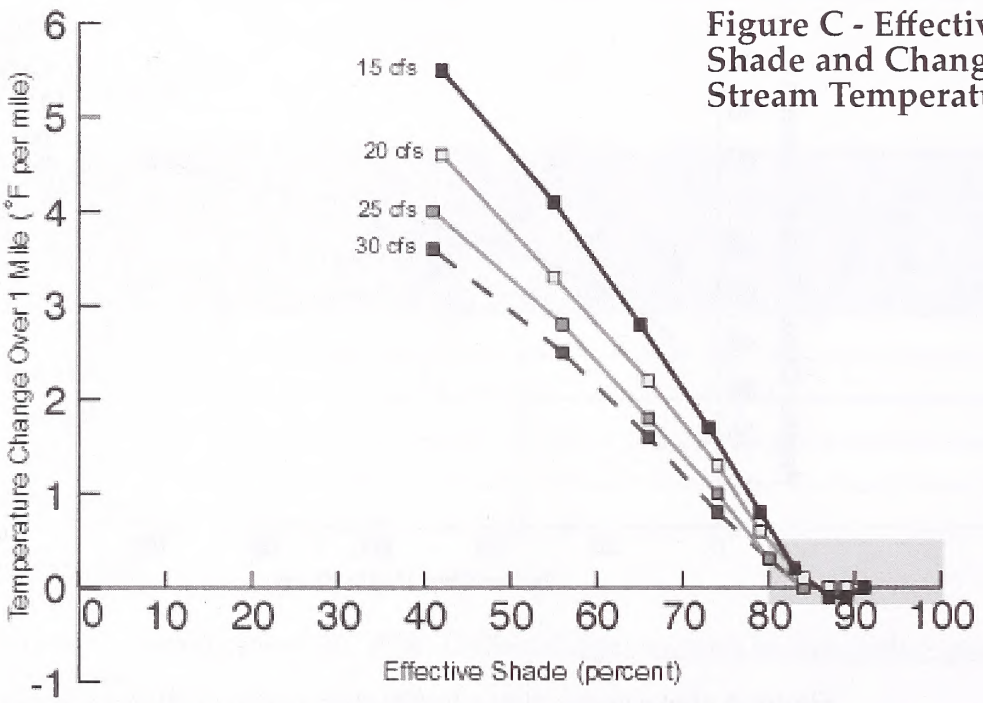

Figure C - Effective Stream Shade and Change in Stream Temperature

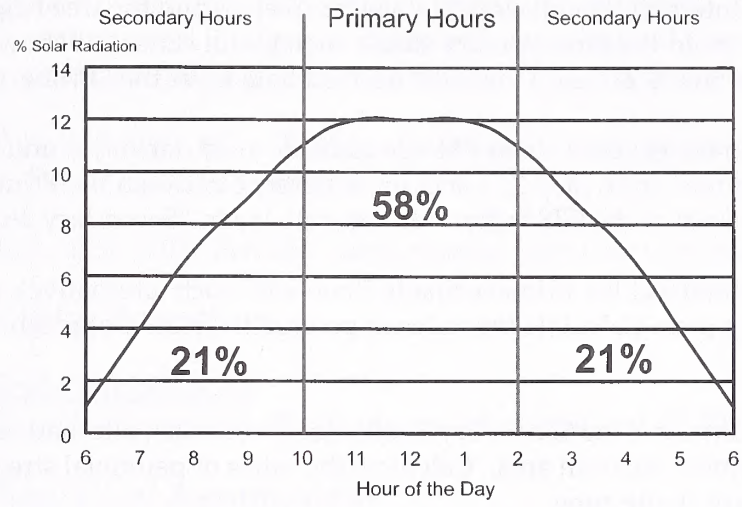

Figure D. Solar Pathfinder (43° to 49° N Lat., Boyd 1999).

Primary Shade Zone Distance of Riparian Trees (In Feet)			
HEIGHT OF TREE	HILL SLOPE <30%	HILL SLOPE 30 TO 60%	HILL SLOPE >60%
Trees < 20 feet	12	14	15 feet
Trees 20 to 60 feet	28	33	55 feet
Trees >60 to 100 feet	50	55	60 feet
Source: Northwest Forest Plan Temperature TMDL Implementation Strategies, 2005.			

Forest treatments are assumed to fully meet effective shade and water quality standards within primary and secondary shade zones along streams, lakes, and wetlands when the following criteria are met:

- The above table will be used to determine the width of the primary shade zone, unless a shade model is used for site-specific analysis. Vegetation thinning in the primary shade zone will not result in less than 80% effective shade.

- Vegetation thinning in the secondary shade zone will not result in less than 50% canopy closure post harvest.

Analytical Methodology and Technique

Step 1 - Reclassify the watercourses GIS data theme to derive a perennial stream data layer.

Step 2 - Buffer the perennial streams, lakes, and wetlands to 100 feet.

Step 3 - Derive a GIS data layer from the contour data theme or Digital Elevation Model raster data, showing hill slopes in the three classes displayed in the Primary Shade Zone table (included in the Assumptions section above). Clip this slope class derived data layer with the stream buffer layer derived from Step 2.

Step 4 - Reclass a copy of the GIS vegetation (FOI) data theme into the tree heights as shown in the above table on Primary Shade Zones. This will be completed by assigning a tree height class, based on regionalized tree growth curve tables applicable to the dominant tree species group of the FOI polygon, using the stand birthdate and site productivity class.

Step 5 - Intersect the hill slope data layer (Step 3) and the tree height class data layer (Step 4), then build the nine primary shade zone width classes as shown in the above table on Primary Shade Zones. Label this derived data layer the "Primary Shade Zone."

Step 6 - Intersect the Primary Shade Zone derived data layer and the buffer derived data layer derived from Step 2. Label the difference between the Primary Shade Zone (Step 5) and the limit of the GIS buffer derived data layer: "Secondary Shade Zone."

Step 7 - Intersect the Primary Shade Zone with each alternative's primary riparian retention area. Calculate the miles of perennial stream not meeting the primary shade zone.

Step 8 - Intersect the Secondary Shade Zone with each alternative riparian variable management riparian area. Calculate the miles of perennial stream not meeting the secondary shade zone.

Analytical Conclusion

- Rank of alternatives by the extent that each alternative riparian area meets the primary and secondary shade zones on BLM-managed lands.

Data Needs

- GIS Watercourses data theme
- GIS Vegetation data theme – Forest Operations Inventory (FOI)
- GIS-derived data layer of each alternative's full riparian retention and variable retention areas.

Data Display

Comparison of Alternatives for Perennial Streams to Meet Primary and Secondary Shade Zones				
Alternative	Perennial Streams Not Meeting Primary Shade Zones (Miles)	% of Total Perennial Stream	Perennial Stream Not Meeting Secondary Shade Zones (Miles)	%of Total Perennial Stream
No Action				
Alternative 1				
Alternative2				
Alternative 3				
Alternative 4				

References

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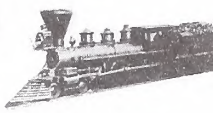

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Source Water Protection

Analytical Question #5

How will each alternative affect source water areas on BLM-managed lands?

Analytical Assumptions

- The Department of Environmental Quality (DEQ) has identified surface source waters used by public water systems. The DEQ has prepared source water assessments for surface waters used by public water systems (ODEQ 2005).

- The DEQ considers sensitive zones to extend for 1,000 feet along all contributing waters within the watershed protection boundary of public water systems.

- Potential contaminant sources that may impact the water supply have been identified as part of the source water assessments. Potential water quality impairment sources from BLM activities may include: regeneration harvest units, stream crossings, road density, river recreation, transmission lines, grazing animals, streambank erosion, and quarries.

- Best Management Practices will be used to protect identified source water areas on BLM-managed lands.

Analytical Methodology and Technique

Step 1 - Rebuild the DEQ GIS Surface Source Water data theme for public water systems into a BLM derived data layer for the plan area. This includes the water protection boundary and sensitive areas for each public water system.

Step 2 - Intersect with BLM GIS ownership (LLI) and watercourses themes. Mask any public water systems downstream of BLM administered lands.

Step 3 - Intersect with Analytical Question #3, Mass Wasting Susceptibility Mapping (Step 5 and 6).

Step 4 - Intersect with Analytical Question #2, Sediment delivery to streams (Step 11).

Analytical Conclusions

- Rank of alternatives by the degree they include regeneration harvest or new road construction with potential sediment delivery within public water system sensitive areas.

Data Needs

- DEQ GIS Public Water Systems theme
- BLM GIS watercourses theme
- 10-year harvest and roads scenarios for each alternative.

Data Display

BLM Management Within Sensitive Zones of Pubic Use Watersheds, By Alternative					
Regeneration Harvest within Sensitive Zones, (Acres)		Roads Within Sensitive Zones (Miles)		Potential Sediment Delivery within Sensitive Zones (Tons/acre/year)	
No Action		No Action		No Action	
Alternative 1		Alternative 1		Alternative 1	
Alternative 2		Alternative 2		Alternative 2	
Alternative 3		Alternative 3		Alternative 3	
Alternative 4		Alternative 4		Alternative 4	

References

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Fire and Fuels

Analytical Question #1

How will alternatives affect fire hazard within the wildland urban interface?

Assumptions

- Treatments will not eliminate fire from the ecosystem.
- Thinning and pruning will reduce crown bulk density and ladder fuels.
- Follow-up treatment of slash will reduce fire hazard.
- Treating ground and ladder fuels will provide the greatest benefit.
- Hazardous fuels will continue to increase within unmanaged areas.
- Values at risk, such as residences and structures, will continue to increase within wildland urban interface areas.

Methodology and Technique

- Effectiveness of treatment will be measured by percentage of acres treated that effectively reduce fire hazard within the wildland urban interface. ("Effectively" is defined by the overall reduction of all categories of fuels.)
- Alternatives will receive a relative ranking from low to high in effectiveness.

Analytical Conclusion

- A ranking of alternatives, identifying the percentage of area where wildfire risk within the wildland urban interface is significantly reduced

Data Needs

- Amount of thinning harvest proposed in this alternative, both within and outside of the wildland urban interface.
- Amount of regeneration harvest proposed in this alternative, both within and outside of the wildland urban interface.
- Amount of pre-commercial thinning proposed both within and outside of the wildland urban interface.
- Location of thinning in relation to wildland urban interface.
- Proposed diameter ranges on thinning from silvicultural prescription.
- Percentage of crown cover retained after thinning is completed.

Data Display

- Maps showing treatment areas with wildland urban interface overlay.

References

Peterson, David L., Johnson, Morris C., Agee, James K., Jain, Theresa B., McKenzie, Donald and Reinhardt, Elizabeth 2005. Forest Structure and Fire Hazard in Dry Forests of the Western United States. USDA Forest Service Pacific Northwest Research Station, Portland, OR. PNW-GTR-628

Rothermel, Richard 1983. How to Predict the Spread and Intensity of Wildfires. GRT-INT-93

Fitzgerald, Stephen A. 2002. Fire in Oregon's Forests: Risks, Effects, and Treatment Options. Chapters 12 and 13.

Analytical Question #2

How does each alternative influence fire resistance across the landscape?

Assumptions

- Treatments will not eliminate fire from the ecosystem.
- Fuels treatments can be effective at a variety of landscape scales.
- Treatment effectiveness is dependent on weather, fuel loadings, and fuel moisture.
- Management actions only influence fuel loadings.
- Weather and fuel moistures are outside of our control.
- Climate change may reduce effectiveness of fuels treatments.
- Harvest prescriptions designed to meet hazard reduction goals of the Healthy Forest Restoration Act will treat ground, ladder, and canopy fuels to reduce hazard.
- Hazardous fuels will continue to increase in unmanaged areas.
- Values at risk, such as wildlife habitat and watershed values, will continue to face increased hazard without some form of fuels treatment.
- Large blocks of even-aged stands with horizontal and vertical fuel continuity are at increased risk for uncharacteristic wild fire.
- Thinning and pruning to reduce crown bulk density, and follow-up treatment of slash to ground and ladder fuels will increase fire resiliency.
- Favoring early-seral species, such as pine, will increase landscape resiliency and resistance to fire.
- Some level of prescribed fire use will provide benefit to stand resiliency and resistance.
- Using larger diameter trees as leave trees will increase fire resistance to both wild and prescribed fire.
- Vegetation developed under, and is adapted to, historic disturbance regimes.
- Fire Regime Condition Class is the appropriate tool to determine departure from historic vegetation and disturbance regimes.
- Fire Regime Condition Class is a long-term indicator of ecosystem resiliency.

Methodology and Technique

- Effectiveness of treatment will be measured according to the percentage of acres treated that effectively increase fire resistance by leaving larger trees on site while reducing ground and ladder fuels. Change of Fire Regime Condition Class will be modeled and trends analyzed.

Analytical Conclusion

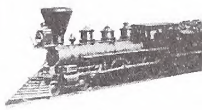
- A determination will be made on trend change of Fire Regime Condition Class.

Data Needs

- Amount of thinning harvest proposed by alternative.
- Amount of regeneration harvest proposed by alternative.
- Amount of pre-commercial thinning proposed by alternative.
- Location of thinnings.
- Proposed upper diameter limits on thinning.
- Crown cover retained after thinning is completed.
- Stands mapped by diameter class and canopy closure.
- Number of acres by diameter class and canopy closure.
- Change in Fire Regime Condition Class, by alternative.
- Number of days active crown fire might be available to occur on a typical site in an average fire season, pre-treatment and then post-treatment.

Data Display

- Map of change in Fire Regime Condition Class.



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Analytical Question #3

How does each alternative affect fire severity (long-term soil damage)?

Assumptions

- Fire severity is defined as long-term soil or site productivity damage.
- Treatments will not eliminate fire from ecosystem.
- Treatments will modify fire behavior.
- Harvest prescriptions designed to meet hazard reduction goals of the Healthy Forests Restoration Act will treat ground, ladder and canopy fuels to reduce hazard.
- Large fuels (1,000- and 10,000-hour) and duff will continue to increase within unmanaged areas, particularly areas designated as late-successional reserves and riparian reserves until a disturbance (such as fire) reduces them.
- Regeneration harvests will increase large fuels in older stands that have a high percentage of cull material. Large fuels will be rearranged as large trees, safety trees, and snags are felled and unmerchantable portions are left onsite. Regeneration harvests will generate moderate to high increases in small fuels (1-,10-, and 100-hour)
- Regeneration harvests will greatly increase large fuels, as well as moderate to high increases in small fuels (1-,10-, and 100-hour)
- Large fuels (1,000-hour and 10,000-hour) have little influence on fire spread rates, but significantly increase fire severity
- Fires in light flashy fuels (1-,10-, and100-hour) may have high rates of spread when they burn, but have minimal long-term soil impacts.

Methodology and Technique

- Acres that have an increased fuel loading in the larger size classes resulting from management actions will be calculated.

Analytical Conclusion

- A determination of the percentage of area where an increased fire severity could result from management actions. Fuel loading will be measured against naturally occurring levels.

Data Needs

- Amount of thinning harvest proposed by alternative.
- Amount of regeneration harvest proposed by alternative.
- Amount of pre-commercial thinning proposed by alternative.
- Location of timber harvests.
- Proposed upper diameter limits on thinning.
- Number of acres in reserves.

Data Display
- Maps showing treatment areas with wildland urban interface overlay.
- Maps showing reserve areas and acreages.
- Maps showing pre-commercial thinning.
- Maps showing harvest areas by prescription.

References

Peterson, David L., Johnson, Morris C., Agee, James K., Jain, Theresa B., McKenzie, Donald and Reinhardt, Elizabeth 2005. Forest Structure and Fire Hazard in Dry Forests of the Western United States. USDA Forest Service Pacific Northwest Research Station, Portland, OR. PN. W-GTR-628.

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Fitzgerald, Stephen A. 2002. Fire in Oregon's Forests: Risks, Effects, and Treatment Options. Chapters 12 and 13.

Analytical Question #4
How does each alternative affect fire intensity, specifically the rate of spread?

Assumptions
- Fire intensity is determined by flame length, as it affects rate of spread.
- Treatments will not eliminate fire from the ecosystem.
- Treatments will modify fire behavior.
- Harvest prescriptions designed to meet hazard reduction goals of the Healthy Forests Reduction Act will treat ground, ladder and canopy fuels to reduce hazard.
- Hazardous fuels will continue to increase within unmanaged areas.
- Values at risk will continue to increase within wildland urban interface areas.
- Thinning and partial cutting prescriptions will result in large increases in light fuels, but low to moderate increases in large fuels.
- Fires in light flashy fuels (1-, 10- ,and 100-hour) may have high rates of spread when they burn, but minimal long-term soil impacts.
- Intensely burned vegetation does not necessarily correlate to high fire severity.

Methodology and Technique
- Acres that have an increased fuel loading in the smaller size classes resulting from management actions will be calculated.

Analytical Conclusion
- A determination of the percentage of area where increased fire intensity is likely to result from management actions. Loading will be measured against naturally occurring levels.

Data Needs
- Amount of thinning harvest proposed in each alternative.
- Amount of regeneration harvest proposed in each alternative.
- Amount of pre-commercial thinning proposed under each alternative.
- Location of thinnings.
- Proposed upper diameter limits on thinning.

Data Display
- Maps showing treatment areas with wildland urban interface overlay.
- Maps showing reserve areas and acreages.

- Maps showing pre-commercial thinning.
- Maps showing harvest areas by prescription.

References

Peterson, David L., Johnson, Morris C., Agee, James K., Jain, Theresa B., McKenzie, Donald and Reinhardt, Elizabeth 2005. Forest Structure and Fire Hazard in Dry Forests of the Western United States. USDA Forest Service Pacific Northwest Research Station, Portland, OR. PNW-GTR-628.

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Air Quality

Analytical Question #1

How will proposed management actions affect air quality?

Assumptions

- Planned and unplanned ignitions will both result in emissions.
- Planned emissions will be regulated under, and comply with, the Oregon Smoke Management Plan.
- Planned ignitions will have minimal short-term impacts on local areas.
- Violations of National Ambient Air Quality standards are unlikely with planned ignitions.
- Unplanned ignitions will impact large areas over long timeframes.
- Violations of National Ambient Air Quality standards are likely with unplanned ignitions.

Methodology and Technique

- Acres burned, location, and type of burning, as well as estimated emissions, over the past decade 1994-2004, will be compared and contrasted to burning proposed to occur over the next decade.

Analytical Conclusion

- A determination will be made as to air quality impacts and level of emissions to be expected over the next 10 years from both wild and prescribed fires. This will be contrasted with the previous decade to provide baseline data for comparison.

Data Needs

- Number of acres by burning type (pile, underburn, etc.), from 1994 to 2004, with acres and tonnages given by location (wildland urban interface or other).
- Projection of acres to be burned in the next 10-year program, with information given in the same format as for 1994-2004.
- Differences in planned acres if they vary by alternative.
- Number of acres burned by wildfire in same time period.

Data Display

- Map showing air quality maintenance areas, Class 1 areas, non-attainment areas, and ownership patterns.

References

Sandberg, David V.; Ottmar, Roger; Peterson, Janice L.; Core, John, 2002. Wildland Fire on Ecosystems: Effects on Air. USDA Forest Service, Rocky Mountain Research Station, Ogden Utah. RMRS-GTR-42-vol 5.

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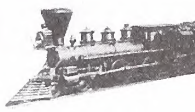


Recreation

Off-Highway Vehicles, Visual Resources, and the National Landscape Conservation System

Analytical Question #1

How would the alternatives affect BLM's ability to contribute to meeting recreation demand on BLM-managed lands across western Oregon?

Analytical Assumptions

- Recreation Demand

  Recreation demand is defined by projected recreation use levels on BLM-managed lands across western Oregon in the year 2015. Projected demand is based on current trends in visitor use levels with the assumption that these trends will remain constant over the next decade. It is measured by the changes in use levels for 13 primary categories of recreational activities. For comparative purposes, use levels for these activities will be measured by the number of participants, visitors, visitor use hours, and/or visitor days.

  The 13 primary categories of recreational activities are:
  - Interpretation, education, and nature study (such as wildlife viewing)
  - Non-motorized travel (such as hiking, biking, horseback riding)
  - Driving for pleasure (such as passenger vehicles on designated roadways)
  - Camping and picnicking
  - Motorized off-highway vehicle travel
  - Hunting (such as big game, upland and migratory game birds)
  - Fishing
  - Non-motorized boating
  - Motorized boating
  - Swimming and other water-based activities
  - Non-motorized winter activities (such as cross-country skiing)
  - Snowmobile and other motorized winter activities
  - Specialized non-motorized activities and events (such as geo-caching, social events, and mountain-bike races)

- Alternatives will primarily vary by types and intensities of forestry management (such as structure modifications of forest stands, harvest rotations, and road building and decommissioning). These alternatives will have varying degrees of effect on each of the recreational activities listed above, depending on the types of activities and settings in which they occur.

- The distribution of recreation demand by setting is based on survey data collected for Oregon's Statewide Comprehensive Outdoor Recreation Plan (SCORP 2003). Results from this statewide analysis have been adapted to match the types of settings and activities that occur on BLM-managed lands in western Oregon. It is assumed that the current distribution of recreation demand will remain constant over the next decade, and that project demand will be distributed in the same way across the landscape.

- Scale of Analysis

  The BLM's approach in meeting recreation demand varies by two distinct land use allocations: Special Recreation Management Areas (SRMAs) and Extensive Recreation Management Areas (ERMAs). The regional distribution of SRMAs and ERMAs ensures that a range of recreational settings and opportunities exists in relative proximity to communities throughout the region. Since each BLM district in western Oregon includes a variety of different SRMAs and ERMAs, a district-level analysis will be used.

- Recreation Settings
  The same activity occurring in different settings can produce different experiences and benefits for visitors. This in turn affects overall visitor use patterns. The types of recreation settings used in this analysis will include: primitive, backcountry, middle country, front country, and rural. The primary factors for analyzing these settings include physical, administrative, and social characteristics. The following describes assumptions associated with forestry management as it relates to each of these setting characteristics:

  Physical Setting Characteristics
  - *Remoteness (proximity to roads, road type, etc.).* Forestry management actions that require road building and decommissioning directly affect this setting characteristic.

  - *Naturalness (landscape quality, level of disturbance, structure complexity of forest stand, etc.).* Forestry management actions that affect forest stand structure and age classes directly influence this setting characteristic.

  - *Facilities (level of on-site improvements, developments, etc.).* Forestry management actions do not generally occur on BLM-managed lands with recreation facilities (such as campgrounds, day-use areas, and trails); therefore, forestry management alternatives will likely not influence this setting characteristic.

  Administrative Setting Characteristics
  Forestry management actions typically do not directly affect regulations governing mechanized use, visitor services, or recreation-related management controls; therefore, forestry management alternatives will not likely influence the following administrative setting characteristics:
  - Mechanized use (motorized vs. non-motorized types of mechanized use)
  - Visitor services (interpretive materials, onsite personnel, etc.)
  - Management controls (regulatory signing, gating, enforcement presence, etc.)

  Transportation management controls on BLM and adjacent private timberlands directly affect public access to for recreation use. Reciprocal right-of-way agreements and the lack of permanent easements may prevent public access entirely to BLM-managed lands, or gating roads may partially limit public access due to vehicular access restrictions.

  Social Setting Characteristics
  Forestry management actions do not directly affect the social setting. These actions primarily affect the physical setting, which indirectly influences recreation demand. Changes in recreation demand in turn affect characteristics of the social setting, including:
  - Contacts (number of encounters with other visitors)
  - Distribution of Visitors (group size, number of visitors per acre per day)
  - Evidence of use (impacts from other visitors)

Analytical Methods and Techniques

Step 1. Determine public accessibility of BLM-managed lands.

Since reciprocal right-of-way agreements and gating on BLM and adjacent private lands can prevent visitors from accessing BLM-managed lands for recreation use, an inventory will first be conducted to determine which BLM-managed lands are legally accessible to the public. The classification of recreation settings will only be completed for those BLM-managed lands that have legal public access, or where public access is currently available through adjacent private property at the discretion of the landowner.

Step 2. Classify recreation settings by alternative.

Recreation settings will be used to analyze the effects of each alternative on recreation demand by BLM district. Since forestry management directly affects the character of the natural landscape, only the 'remoteness' and 'naturalness' aspects of the physical setting will be used for this analysis. Existing recreation settings for 'remoteness' and 'naturalness' will be compared to those modified over a 10-year period for each alternative by a percentage of BLM lands in each district (see the table entitled Classification of Physical Settings by Alternative for each BLM District, included later in this section).

Step 3. Characterize experiences and benefits by recreation setting.

After existing and modified setting classifications are determined for each district, they will be associated with experiences and benefits derived from them (see example tables of Characterization of Primary Experiences and Benefits Derived from each Recreation Setting). This association will later be used as part of the evaluation to determine the potential gain or loss of experiences and benefits by alternative.

Step 4. Determine recreation demand by district.

The next step will be to determine projected visitor use levels for recreational activities that occur within each district over the next 10 years. This will be estimated using a combination of BLM's Recreation Management Information System (RMIS) and survey results from Oregon's Statewide Comprehensive Outdoor Recreation Plan (SCORP 2003).

The distribution of recreation demand by setting will then be determined, using survey results from Oregon's Statewide Comprehensive Outdoor Recreation Plan (see the map entitled Distribution of Recreation Demand by Setting, included later in this section). The distribution of demand will only be calculated for those activities and settings that occur within each district.

Step 5. Evaluate alternatives.

For each alternative, recreation demand will then be compared to: (1) setting classifications determined for each forestry management alternative, (2) experiences and benefits derived from each setting, and (3) distribution of demand by recreational activity and setting.

This integrated analytical approach will provide a systematic way of evaluating each alternative's effect on BLM's ability to meet projected recreation demand, based on visitors' abilities to attain different opportunities, experiences, and benefits along a continuum of recreation settings.

Analytical Conclusion

- Results from this analysis will show how different alternatives affect BLM's ability to meet recreation demand.

Data Needs

Visitor Use Data

- Projected visitor use levels on BLM-managed lands in western Oregon for the 13 categories of recreational activities, estimated using visitor use data from BLM's Recreation Management Information System (RMIS). The distribution of recreation demand by setting will be determined using survey results from Oregon's Statewide Comprehensive Outdoor Recreation Plan (SCORP).

GIS Coverages

- Identify polygons of Special Recreation Management Areas (SRMAs) and Extensive Recreation Management Areas (ERMAs), including the location of recreation facilities to determine distribution of recreation opportunities by district.
- Roads, including type (such as paved and gravel) and proximity (buffered 1 mile and 0.25 miles) to determine remoteness for the physical setting over a 10-year period for each alternative.
- Forest-stand structure modifications and/or age class to determine the naturalness of the physical setting over a 10-year period for each alternative.
- Access rights attributes and gate locations, from the Ground Transportation Network (GTRN) GIS layer, to determine acres of BLM-managed lands accessible or inaccessible to the public.

Recreation Inventory Data

- Facilities inventory for each area designated as Special Recreation Management Area and Extensive Recreation Management Area, using the Facility Assessment Management System database (FAMS).

Data Display

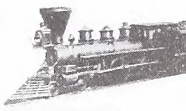
- Table showing classification of physical settings by district (see example)
- Table showing distribution of recreation demand by setting for each district.
- Maps showing BLM-managed lands accessible or inaccessible to the public by district.
- Maps showing the distribution of physical settings by district.

Classification of Physical Settings by Alternative for each BLM District.

	Primitive	Backcountry	Middle Country	Front Country	Rural
Remoteness (proximity to roads, road type, etc.)					
Remoteness	< 1 mile from any class of road, excluding those closed or decommissioned.	0.25 – 1 mile from any class of road, excluding those closed or decommissioned.	On or near gravel or dirt roads (within 0.25 mile of these types of roadways).	On or near improved paved roads (within 0.25 mile of these types of roadways).	On or near primary highways, but still within a rural setting (within 0.25 mile).
Percentage of existing lands					
Percentage of modified lands					

Naturalness (landscape quality, level of disturbance, forest stand structure complexity, age class, etc

	Primitive	Backcountry	Middle Country	Front Country	Rural
Naturalness	Undisturbed landscape; typically older, complex forest stand structure with multiple canopies that include shade-tolerant species, snags, down wood and a diverse understory.	Naturally-appearing landscape having modifications not readily noticeable; an older forest with layered stand structure with at least two canopies and a diverse understory would be maintained over most of the setting.	Naturally-appearing landscape with more noticeable modifications to forest stand structure; a mature forest setting with an open stand structure; at least one canopy and a diverse understory layer would be maintained over most of the setting.	Partially modified landscape, yet does not overpower natural features; open single canopy stand structure with an understory layer of shrubs and herbs would be maintained over some of the setting. As a result of more request harvests, younger forest stands would be more observable.	Substantially modified natural landscape; forest structure ranges from a regenerated stand to a closed single canopy with little understory vegetation would dominate this setting.
Percentage of existing lands					
Percentage of modified lands					



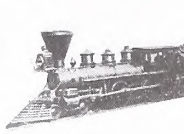
Characterization of Primary Experiences and Benefits Derived from each Recreation Setting *

	Primitive	Backcountry	Middle Country	Front Country	Rural
Experiences	Extremely high probability of experiencing isolation from the sights and sounds of humans, independence, closeness to nature, tranquility, and self-reliance through application of outdoor skills in an environment that offers challenge and risk.	High, but not extremely high, probability of experiencing isolation from the sights and sounds of humans, independence, closeness to nature, tranquility, and self-reliance through application of outdoor skills in an environment that offers challenge and risk.	Moderate probability of experiencing isolation from the sights and sounds of humans, independence, closeness to nature, tranquility, and self-reliance through application of outdoor skills in an environment that offers challenge and risk. Opportunity to have a high degree of interaction with the natural environment. Opportunity to use motorized equipment while in the area.	About equal probability to experience affiliation with other user groups and for isolation from the sights and sounds of humans. Opportunity to have a high degree of interaction with the natural environment. Challenge and risk opportunities associated with more primitive type of recreation are not very important. Practicing outdoor skills might be important. Opportunities for both motorized and non-motorized recreation are possible.	Probability for experiencing affiliation with other individuals and groups is prevalent, as is the convenience of sites and opportunities. These factors are generally more important than the setting of the physical environment. Opportunities for wildland challenges, risk-taking, and testing of outdoor skills are generally unimportant.
Personal Benefits	Extremely high probability of personal development and growth, improved mental health and physical fitness, personal appreciation and satisfaction, and introspection.	High probability of personal development and growth, improved mental health and physical fitness, personal appreciation and satisfaction, and introspection.	Moderately high probability of personal development and growth, improved mental health and physical fitness, and personal appreciation and satisfaction.	Improved outdoor skills and enjoyment with others. Stronger ties with family and friends.	Improved outdoor skills and enjoyment with others. Stronger ties with family and friends. Greater respect for other visitors and rural lifestyles.
Social and Economic Benefits	Greater family bonding. Decreased over-crowding, crime, and vandalism due to access limitations. Positive contribution to local and regional economic stability. Improvement of adjacent community's distinctive tourism niche.	Greater family bonding. Decreased over-crowding, crime, and vandalism due to access limitations. Positive contribution to local and regional economic stability. Improvement of adjacent community's distinctive tourism niche.	Greater family bonding. Heightened sense of community importance. Improved economic stability and job opportunities. Improvement of community's distinctive character.	Improved integration of family with community. Heightened sense of community importance. Improved economic stability and job opportunities. Improvement of community's distinctive character.	Improved integration of family with community. Heightened sense of community importance. Improved economic stability and diversification of job opportunities. Increased desirability as a place to live. Improvement of community's distinctive character.
Environmental Benefits	Maintenance of distinctive recreation setting character. Adjacent community ownership and stewardship of natural surroundings.	Maintenance of distinctive recreation setting character. Adjacent community ownership and stewardship of natural surroundings.	Maintenance of distinctive recreation setting character. Adjacent community ownership and stewardship of natural surroundings.	Maintenance of distinctive recreation setting character. Community ownership and stewardship of natural surroundings.	Maintenance of distinctive small-town atmosphere and culture. Community ownership and stewardship of natural surroundings.
Disadvantages	Increased cost-of-living in nearby communities may occur as recreation demand increases.	Increased cost-of-living in nearby communities may occur as recreation demand increases.	Increased crime, vandalism, over-crowding, user conflicts, and cost-of-living in nearby communities may occur as recreation demand increases.	Increased crime, vandalism, over-crowding, user conflicts, and cost-of-living in nearby communities may occur as recreation demand increases.	Increased crime, vandalism, over-crowding, user conflicts, and cost-of-living in nearby communities may occur as recreation demand increases.

* Disadvantages are also included to contrast the benefits derived from each setting.

Distribution of Recreation Demand by Setting (percentage of visitor use)*						
Activity	**Primitive**	**Backcountry**	**Middle Country**	**Front Country**	**Rural**	**Total**
Interpretation, education, & nature study	9	19	42	11	19	100
Non-motorized travel	15	23	36	9	17	100
Driving for pleasure	0	0	67	15	18	100
Camping and picnicking	6	13	49	20	12	100
Motorized off-highway vehicle travel	0	0	58	14	28	100
Hunting	22	26	27	19	6	100
Fishing	21	15	38	13	13	100
Non-motorized boating	17	17	27	11	28	100
Motorized boating	0	0	41	17	42	100
Swimming and other water based activities	6	17	47	9	21	100
Non-motorized winter activities	9	9	9	23	50	100
Snowmobile and other motorized winter activities	0	0	11	28	61	100
Specialized activities and events	4	9	22	17	48	100
Distribution of Overall Demand by Setting	**8**	**11**	**37**	**16**	**28**	**100**

* Based on survey data collected for Oregon's Statewide Comprehensive Outdoor Recreation Plan (Table 3.7. *Statewide Demand for Outdoor Recreation Resource Settings*, SCORP 2003, p. 3-27). It has been adapted to match the types of settings and activities that occur on BLM lands in western Oregon.



Off-Highway Vehicle (OHV) Management

Analytical Question #2

How would re-designation of some off-highway vehicle areas affect BLM's ability to contribute to meeting off-highway vehicle use demand on certain BLM-managed lands?

Analytical Assumptions

Recreation Demand: Off-highway vehicle demand is defined by projected OHV-use levels on BLM-managed lands across western Oregon in the year 2015. It is measured by changes in OHV-use levels, which are based on current trends. For comparative purposes, use levels will be measured by the number of participants, visitors, visitor use hours, and/or visitor days.

Scale of Analysis: All BLM-managed lands are allocated as open, limited, or closed to off-highway vehicle activities. These land use allocations directly relate to BLM's ability to help meet projected increases in the demand for off-highway vehicle use, on BLM-managed lands across the region. Because of this, the distribution of land use allocations for off-highway vehicle use, for each BLM district, will be the scale used for the analysis.

Primary Factors of the Analysis: Changing the size and distribution of land use allocations for off-highway vehicle use has a direct effect on off-highway vehicle use patterns, which influence: (1) off-highway vehicle use opportunities, (2) public safety, and (3) user conflicts. The interrelationship between these three primary factors can be attributed to each land use allocation for off-highway vehicle use. These factors will be used in combination with projected use levels of off-highway vehicles to determine if demand is being met within each BLM district.

Analytical Methods and Techniques

Step 1. Classify land use allocations for off-highway vehicle use.

Existing and re-designated land use allocations for off-highway vehicle use will be classified and mapped by alternative for each BLM district. (See the table entitled Classification of OHV Land Use Allocations, included later in this section.)

Step 2. Characterize land use allocations for off-highway vehicle use.

The framework for characterizing each land use allocation for off-highway vehicle use will consider: the level of opportunities for off-highway vehicle use; public safety; and user conflicts (see the table entitled Characterization of OHV Land Use Allocations, included later in this section). This association will be used as part of the evaluation to determine potential benefits or disadvantages related to each alternative.

Step 3. Determine the demand for off-highway vehicle use, by BLM district.

Projected demand for off-highway vehicle use will be determined for each district. This will be estimated using BLM's Recreation Management Information System (RMIS) and survey data collected from Oregon's Statewide Comprehensive Outdoor Recreation Plan (SCORP 2003).

Step 4. Evaluate alternatives.

For each alternative, the demand for off-highway vehicle use will be compared to opportunities for off-highway vehicle use, public safety, and user conflicts associated with re-designated land use allocations for off-highway vehicle use.

Analytical Conclusion

- Ranking of alternatives showing effects that re-designation of various land use allocations for off-highway vehicle use will have on BLM's ability to meet projected demand for off-highway vehicle use.

Data Needs

Visitor Use Data

- Visitor use data for off-highway vehicle use, based on estimates from BLM's Recreation Management Information System (RMIS 2004) and survey data from Oregon's Statewide Comprehensive Outdoor Recreation Plan (SCORP 2003).

GIS Coverages

- Land use allocation polygons for off-highway vehicle use, including acres for existing and proposed areas.
- Road and trail networks for areas where off-highway vehicle use is limited to designated routes.

Data Display

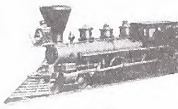
- Tables and maps that show existing and re-designated land use allocations for off-highway vehicle use (see example format of tables below).

Classification of OHV Land Use Allocations for each BLM District.

	Closed	Limited to Designated Routes	Limited to Existing Routes	Open
Percentage of existing lands				
Percentage of modified lands				

Characterization of OHV Land Use Allocations.

	Closed	Limited to Designated Routes	Limited to Existing Routes	Open
OHV Opportunities	Increasing the amount of 'closed' areas excludes OHV opportunities within these areas.	Increasing the amount of OHV areas that are 'limited to designated routes' would enhance OHV opportunities in areas that are designated and managed specifically for OHV use.	Increasing the amount of OHV areas that are 'limited to existing routes' would ensure continued OHV opportunities for those areas re-designated from 'open.'	'Open' OHV areas that are specifically designed and managed for OHV use would increase OHV opportunities.
Public Safety	Increasing the amount of 'closed' areas increases public safety within these areas. It may decrease public safety in 'open' and 'limited' areas due to the displacement OHV users to those areas.	Increasing the amount of OHV areas that are 'limited to designated routes' would increase public safety in areas that are managed specifically for OHV use due to the increase in on-site management controls.	Increasing the amount of OHV areas that are 'limited to existing routes' would enhance general public safety for those areas re-designated from 'open.'	Increasing the amount of 'open' areas may decrease public safety for non-OHV users. 'Open' OHV areas that are specifically designed and managed for OHV use may increase public safety in other areas not 'open' for OHV use.
User Conflicts	Increasing the amount of 'closed' areas decreases user conflicts within these areas. It may increase user conflicts in 'open' and 'limited' areas due to overcrowding of OHV users displaced to those areas.	Increasing the amount of OHV areas that are 'limited to designated routes' would decrease user conflicts in certain areas that are managed specifically for OHV use due to the added level of on-site management controls.	Increasing the amount of OHV areas that are 'limited to existing routes' would decrease user conflicts for those areas re-designated from 'open.'	Increasing the amount of 'open' areas may increase user conflicts for non-OHV users. 'Open' OHV areas that are specifically designed and managed for OHV use may decrease user conflicts in other areas not 'open' for OHV use.



Visual Resource Management (VRM)

Analytical Question #3

How would varying types and intensities of forestry management affect visual resource quality on BLM lands?

Analytical Assumptions

- All BLM-managed lands are required to be designated as VRM Class I, II, III, or IV. In the previous resource management plans, visual resource management classes were designated differently than they were inventoried due to forestry management priorities. Since these designated VRM classes are considered to be consistent with the O&C Act, this classification system will continue to be used.

Analytical Methods and Techniques

Step 1. Classify existing Visual Resource Management class allocations.

Existing Visual Resource Management class allocations will be classified and mapped for each district, based on the previous resource management plans.

Step 2. Evaluate alternatives for consistency with Visual Resource Management class allocations.

Evaluate each alternative to determine its consistency with goals, objectives, and forestry management guidelines established for the existing Visual Resource Management class allocations (see table entitled "Criteria for Visual Resource Management Classes" on following page).

Analytical Conclusions

- Each alternative will show to be consistent with the goals, objectives, and forestry management guidelines for each of the existing Visual Resource Management class allocations.

Data Needs

- GIS coverages
- Visual Resource Management class polygons, including acres, established in the previous resource management plans for each BLM district.

Data Display

- Maps and tables to compare Visual Resource Management classes with forestry management alternatives for each district.

Criteria for Visual Resource Management Classes

	VRM Class I	VRM Class II	VRM Class III	VRM Class IV
Goal	Preserve the existing character of the landscape.	Retain the existing character of the landscape.	Partially retain the existing character of the landscape.	Allow for major modification of the existing character of the landscape.
Objectives	• Provide for natural ecological changes • Does not preclude very limited management activity • Level of change to the characteristic landscape should be very low and must not attract attention	• Low level of change to the characteristic landscape • Management activities may be seen, but should not attract the attention • Changes must repeat the basic elements of form, line, color, and texture found in predominant natural features of the landscape.	• Moderate level of change to the characteristic landscape • Management activities may attract attention but should not dominate the view • Changes should repeat the basic elements found in predominant natural features	• High level of change to the existing characteristic landscape • Management activities may dominate the view and be the major focus of viewer attention • Minimize the impact of these activities through careful location, minimal disturbance, and repeating the basic elements
Land Use Allocations	Congressionally-designated wilderness areas and administratively designated wilderness study areas.	Some examples include certain Wild and Scenic River corridors, Back Country Byways, forest land adjacent (within 0.25 miles) to developed recreation sites and state and federal highways.	Lands adjacent (within 0.25 miles) to most county roads and rural residential areas.	All other available forest lands except as noted under rural interface area management.
Structure-based Forestry Management Guidelines	Undisturbed landscape; typically older, complex forest stand structure with multiple canopies that includes shade-tolerant species, snags, down wood and diverse understory.	Naturally-appearing landscape having modifications not readily noticeable; layered forest stand structure with at least two canopies and diverse understory.	Naturally-appearing landscape with more noticeable modifications yet they do not overpower natural features; open single canopy structure with an understory layer of shrubs and herbs is typical.	Varies from substantially to partially modified landscape. Any of the forestry management approaches described for VRM Class I, II, or III may be applied within this class. Forest stand structure may also vary from regeneration to a closed single, main canopy with limited understory vegetation.
Percent of BLM Lands Consistent with each VRM Class by Alternative				

National Landscape Conservation System

National Landscape Conservation System (NLCS) designations are not affected by the resource management plan revisions. These areas will continue to be managed as they are currently being managed. These areas are not managed for forest production and do not require an analysis of forestry management alternatives, with the exception of Wild and Scenic Rivers.

Once classified as "Wild," "Scenic," or "Recreational," a Wild and Scenic River must be managed to maintain that classification within its established corridor. Timber harvest practices on BLM-managed lands within "Scenic" and "Recreational" river corridors must be designed to achieve land management objectives consistent with the protection and enhancement of the "outstanding and remarkable values" that caused the river to be added to the National Wild and Scenic River System. These management guidelines were completed as part of the planning process for each designated Wild and Scenic River. An analysis of forestry management alternatives within Wild and Scenic River corridors will be based on their compatibility with each Wild and Scenic River Management Plan and their associated "outstanding and remarkable values."

The National Landscape Conservation System designations include:

- National Monuments
- Wilderness Areas
- Wilderness Study Areas
- National Scenic and Historic Trails
- Congressionally designated Outstanding Natural Areas
- Wild and Scenic Rivers

Soils

Analytical Question #1

What are the effects of timber harvest on soil quality in terms of soil disturbance?

Analytical Assumptions

- Soil quality is the capacity of a specific kind of soil to function, within natural or managed ecosystem boundaries, to sustain plant and animal productivity, maintain or enhance water and air quality and to support human health and habitation. Changes in the capacity of soil to function are reflected in soil properties that change in response to management or climate.

- Soil disturbance from timber harvest includes compaction, displacement, and bared soils.

- Harvest system impacts can range from minimal impacts to soil quality, to detrimental. The range of impacts can vary depending on local soil conditions, logging system, harvest type, harvest planning, layout, and implementation. Due to these variables, the following detrimental disturbance levels will be used as an analytical tool: all ground based methods - 31%; skyline - 3.1%; helicopter 1.2%.

Analytical Methods and Techniques

- Calculate amount of soil disturbance due to timber harvest by multiplying the areal extent of the yarding method times the assumed percentages for each fifth-field watershed.

  (Acres of practice X % listed in assumption = Acres of soil disturbance)

Analytical Conclusion

- Alternatives ranked for soil disturbance, based on anticipated acres by harvest method and anticipated disturbance by fifth-field watershed.

Data Needs

- Acres to be harvested by silvicultural system and logging method by alternative by fifth-field watershed from the OPTIONS model.

Data Display

- Compare each alternative using a pie chart to display the total number of acres being harvested for the alternative, each pie slice representing acres of each method of harvest, then another slice depicting acres of soil disturbance by method.

- Another pie chart will be used to depict total acres harvested by alternative with a slice representing total acres of soil disturbance.

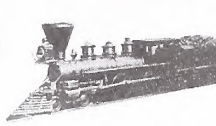
Analytical Question #2

What are the effects of permanent roads and landings in terms of soils not available for plant growth?

Analytical Assumptions

- Permanent roads and landings by definition reduce the soil functions necessary for plant growth, for all intents and purposes, to zero.

- All permanent roads and landings will take those soils out of the harvest land base and unavailable for tree production.



Analytical Methods and Techniques

- Estimate the acreage of new permanent roads and landing by alternative by fifth-field watershed. Calculate the acreage of detrimental soil disturbance by multiplying the length of new roads times their width plus acres of new landings.

  (length of road X width of road)/43,560sq ft + Ac. of new landings = Ac. of soils unavailable for plant growth by 5th field watershed

Analytical Conclusion

- Alternatives ranked for the new acreage of soils taken out of the harvest land base by fifth-field watershed due to permanent roads and landings.

Data Needs

- Estimated acres of new permanent roads and landings by alternative by fifth-field watershed.

Data Display

- Compare each alternative using a pie chart to display the total number of acres in the harvest land base for each alternative, with a pie slice representing the acres of new roads and landings taken out of the harvest land base.

Analytical Question #3

What are the effects of prescribed fire on soils?

Analytical Assumptions

- The magnitude of the change in soil properties increases as the amount of heat increases and radiates downward. "Pile and burn" causes the most detrimental change in soil properties due to the depth and magnitude of heating and the duration of the burn. All (100%) of the soil directly beneath burn piles is expected to have detrimental soil damage due to deep burning.

- Broadcast and fuel reduction burns tend to cause smaller changes over a much wider area. These fires tend to have a mosaic of light, moderate, and deep burns. The deep soil damaging burns are expected to cover 5% of the area.

Analytical Methods and Techniques

- Estimate the acreage of prescribed fire for broadcast burn/fuel reduction projects and pile and burn by alternative by fifth-field watershed. Calculate the amount of detrimental soil disturbance by multiplying the areal extent of burning technique by the assumed percentages. See equations below:

  (Acres of pile and burn X 1 = Acres of detrimental soil disturbance for each fifth-field watershed)
  (Acres of broadcast/fuel reduction burns X .05 = Acres of detrimental soil disturbance for each fifth-field watershed)

Analytical Conclusion

- Alternatives ranked for the potential of detrimental soil damage, based on the number of acres of each kind of prescribed fire by fifth-field watershed.

Data Needs

- Acres of slash disposal by method and acres of fuel reduction, by alternative and fifth-field watershed.

Data Display

- Compare each alternative using a pie chart to display the total number of acres being burned for the alternative, each pie slice representing acres of each method of burning, then another slice depicting detrimental soil effects by method.

References

USDA Forest Service. September 2005. Wildland Fire in Ecosystems-Effects of Fire on Soil and Water. General Technical Report RMRS-GTR-42-vol.4.

Analytical Question #4

What are the effects of mechanical fuel reduction on soil quality in terms of detrimental soil disturbance?

Analytical Assumptions

- Soil disturbance from mechanical fuel reduction techniques (including slashbusting and/or grinding, mowing and mastication, and crushing) can include compaction, displacement, and bare soils.

- Mechanical fuel reduction impacts can range from minimal to detrimental. The range of impacts can vary, depending on local soil conditions, and implementation. Due to these variables, the detrimental soil disturbance will assumed to be 5% of a unit.

Analytical Methods and Techniques

- Calculate the amount of soil disturbance due to mechanical fuel reduction for each fifth-field watershed by multiplying the areal extent times the assumed percentage. See equation below:

(Acres of mechanical fuel reduction) X .05 = Acres of detrimental soil disturbance)

Questions for Scientists

- Is there any information in the literature that has been overlooked that would change the level of the detrimental soil disturbance assumption?

A literature base for this subject is lacking. The analytical assumptions regarding detrimental disturbance come from field-level government soil scientists who have some experience with this kind of equipment and its qualitative effects. The detrimental soil effects described ranged from "next to nothing" to 10% of a unit.

Analytical Conclusion

- Alternatives ranked for detrimental soil disturbance based on the anticipated acres of mechanical fuel reduction and the level of disturbance by fifth-field watershed.

Data Needs

- Acres to be treated for fuel reduction by mechanical means by alternative by fifth-field watershed.

Data Display

- Compare each alternative using a pie chart to display the total number of acres being mechanically treated by alternative, with a pie slice representing acres of detrimental soil disturbance.

References

Personal communication with BLM and USFS personnel and a monitoring report from the Umatilla National Forest.

Bennett M, Fitzgerald S. Reducing Hazardous Fuels on Woodland Properties: Mechanical Fuels Reduction. Oregon State University, College of Forestry, OSU Extension Fact Sheet. (Undated)

Analytical Question #5

What are the effects of livestock grazing on soil quality in terms of rangeland health?

Analytical Assumptions

- Soil disturbance from livestock grazing includes: compaction, bared soils, and loss of organic matter.
- The rangeland health standards include standards for soil quality. Eleven of the seventeen indicators for rangeland health are soil related.
- A preponderance of evidence is used to determine whether the site meets rangeland health standards or does not the standards, based on the degree of departure from an Ecological Site Description and/or Ecological Reference Area.
- If rangeland health standards are met, then soil quality is met and the converse is also true.

Analytical Methods and Techniques

- Determine the number of acres that meet or do not meet the rangeland health standards based on livestock use.

Analytical Conclusion

- Alternatives ranked by the numbers of acres that do not meet rangeland health standards and therefore detrimental soil disturbance is occurring.

Data Needs

- Number of acres available for livestock grazing by alternative.
- Number of acres that do not meet the rangeland health standards due to livestock grazing by alternative.
- Number of acres not assessed by alternative.

Data Display

Compare each alternative using a pie chart to display the total number of acres available for livestock grazing for each alternative, with a pie slice representing acres that meet or do not meet rangeland health standards due to livestock use, and those acres that have not been assessed.

References

Pellant, M., P. Shaver, D.A. Pyke, and J.E. Herrick. 2000. Interpreting Indicators of Rangeland Health, version 3. Interagency Technical Reference 1734-6, USDI, Bureau of Land Management, National Science and Technology Center, Denver, Co.

USDI, Bureau of Land Management. 1997. Standards for Rangeland Health and Guidelines for Livestock Grazing Management For Public Lands administered by the Bureau of Land Management in the States of Oregon and Washington.

Analytical Question #6

What are the effects of off-highway vehicle use on soil quality in terms of detrimental soil disturbance?

Analytical Assumptions

- Soil disturbance from off-highway vehicle use, including compaction, displacement, and bared soils.

Analytical Methods and Techniques

- Describe the detrimental soil effects that can occur with off-highway vehicle use.

Analytical Conclusion

- Off-highway vehicle use can be detrimental to soil quality. Specifics will come later.

Data Needs

- Number of acres with the "Open" designation.
- Number of acres/miles of trails that could occur in the "Open" areas.

Data Display

- Compare alternatives using a pie chart to display the total number of acres available for unrestricted off-highway vehicle use for each alternative, with a pie slice representing the number of acres/miles of trails that could detrimentally impact soils in the "Open" areas.

Livestock Grazing

Analytical Question #1

How would the alternatives affect BLM's ability to meet the Animal Unit Month (AUM) allocation set by the resource management plan on those lands allocated for livestock grazing?

Analytical Assumptions

- The only management actions expected to affect livestock grazing would be those actions occurring on lands allocated for grazing (Coos Bay and Medford Districts, Klamath Falls Resource Area).

- The effects of timber management, silviculture actions, and prescribed fire have the highest potential to impact livestock grazing allocations through changes in vegetation.

- Changes in vegetation associated with management actions may increase or decrease the quality and quantity of forage available and allocated to grazing. Examples are described below:
  - In the short term, timber management actions can create a more open timber stand that allows for an increase of herbaceous vegetation. In the long term, these management actions can result in closed canopies with less available understory.
  - In the short term, prescribed fire can reduce the quantity and quality of herbaceous vegetation. In the long term, prescribed fire can increase the quality and quantity of herbaceous vegetation.
  - In the short term, vegetation manipulation can reduce the quantity of herbaceous vegetation. In the long term, vegetation manipulation can increase the quantity of herbaceous vegetation.

- The effects of other actions, such as protection of special areas through exclusion, will affect the livestock grazing allocations to a lesser degree than those described above.

- Forage production varies by vegetation community and condition. Based on existing vegetation information, XX acres allocated for grazing has the capability to support XX number of animal unit months. This assumption will be used to analyze proportional changes in the quantity and quality of vegetation through expected changes in forage production and not to change existing forage allocations.

- Any adjustments in forage allocations will be based on monitoring and evaluation of site specific information. Forage allocation levels are also based allotment specific management such as suitability, livestock distribution, and season of use in addition to production.

Analytical Methods and Techniques

- Quantitatively describe potential changes in forage production to meet the resource allocations on those lands allocated for livestock grazing.
  - Use ecological site descriptions and/or inventories from soil series data, or other vegetation inventories to assess current vegetation conditions and potential forage production by vegetation communities or classes.
  - Stratify by vegetation community and within communities by condition class.
  - Construct a matrix of forage production by ecological site and condition class for each vegetation community or class.
  - Compare expected changes in forage production among the alternatives.
  - Quantitatively describe, among the alternatives, whether changes in quality and quantity of forage production are expected to increase, decrease, or not change.

Analytical Conclusions

- The alternatives will be ranked as to whether changes in quality and quantity of forage production are capable of meeting the resource allocations on those lands allocated for livestock grazing.

Data Needs

- Map of lands allocated for grazing overlain with land status and site-specific land use allocations or designations.
- Map of lands allocated for grazing overlain with vegetation manipulation areas, timber management and silvicultural actions, and prescribed fire treatment areas proposed within each alternative.
- Acres of vegetation manipulation areas, timber management and silvicultural actions, and prescribed fire treatment areas proposed within each alternative.
- Acres of site-specific land use allocations or designations.
- Soil series and names.
- Ecological site descriptions by soil type.

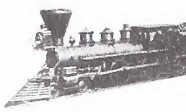
Data Display

- Table showing a comparison of the effects on the quality and quantity of forage production by alternative and proposed management activity.

References

USDA. Natural Resources Conservation Service. 2003. National range and pasture handbook. Washington, D.C.

USDA. Natural Resources Conservation Service. Ecological Site Description System for Rangeland and Forestland data. Online: <http://esis.sc.egov.usda.gov>.



Wild Horses

Analytical Question #1

How would the alternatives affect BLM's ability to maintain the Appropriate Management Level of 30 to 50 wild horses within the Pokegama Herd Management Area?

Analytical Assumptions

- The only management actions that will affect the wild horse herd are those occurring within the Pokegama Herd Management Area.
- The Pokegama Herd Management Area encompasses a total of 80,885 acres, of which 67,869 acres are public, private, and State land within the planning area.
- The Appropriate Management Level of 30 to 50 wild horses need 150 animal unit months.
- The acreage within the Pokegama Herd Management Area supports the Appropriate Management Level of 30 to 50 wild horses.
- The effects of timber management and silviculture actions, prescribed fire, and livestock grazing have the highest potential to impact the wild horse herd through changes in vegetation.
- Changes in vegetation associated with management actions may increase or decrease the quality and quantity of forage production in the herd management area. Examples are described below:
  - In the short term, timber management actions can create a more open timber stand that allows for an increase of herbaceous vegetation. In the long term, these management actions can result in closed canopies with less available understory, but increased thermal cover.
  - In the short term, prescribed fire can reduce the quantity and quality of forage production. In the long term, prescribed fire can increase the quality and quantity of herbaceous vegetation.
  - In the short term, vegetation manipulation can reduce the quantity of herbaceous vegetation. In the long term, vegetation manipulation can increase the quantity of herbaceous vegetation.
- The effects of other actions, such as protection of special areas through exclusion and off-highway vehicle designations, will affect the wild horse herd to a lesser degree. Off-highway vehicle use can disturb or harass wild horses.
- More restrictions have the potential to reduce disturbance, and fewer restrictions can increase disturbance.
- Forage production varies by vegetation community and condition. This assumption will be used to analyze proportional changes in the quantity and quality of vegetation through expected changes in forage production

Analytical Methods and Techniques

Quantitatively, describe potential changes to the wild horse herd through changes in vegetation by doing the following:

- Use ecological site descriptions and/or inventories from soil series data, or other vegetation inventories to assess current vegetation conditions and potential forage production by vegetation communities or classes.
- Stratify by vegetation community and within communities by condition class.
- Construct a matrix of forage production by ecological site and condition class for each vegetation community or class.
- Compare expected changes in forage production among the alternatives.
- Quantitatively describe among the alternatives whether changes in quality and quantity of forage production are expected to increase, decrease, or not change.

Analytical Conclusions

- Alternatives will be ranked as to whether changes in quality and quantity of forage production and overall habitat are capable of maintaining the Appropriate Management Level of 30 to 50 wild horses.

Data Needs

- Map of the Pokegama Herd Management Area with public and private lands overlain showing site-specific land use allocations or designations.

- Map of the Pokegama Herd Management Area with public and private lands overlain with vegetation manipulation areas, timber management and silvicultural actions, and prescribed fire treatment areas proposed within each alternative.

- Acres of vegetation manipulation areas, timber management and silvicultural actions, and prescribed fire treatment areas proposed within an alternative.

- Acres of site-specific land use allocations or designations.

- Soil series and names.

- Ecological site descriptions by soil type.

Data Display

- Table comparing effects on the wild horse herd, quality and quantity of forage production, and overall habitat by alternative and proposed management activity.

- Graph displaying differences between alternatives with the allocation level as the threshold.

References

USDA. Natural Resources Conservation Service. 2003. National range and pasture handbook. Washington, D.C.

USDA. Natural Resources Conservation Service. Ecological Site Description System for Rangeland and Forestland data. Online: <http://esis.sc.egov.usda.gov>.

Areas of Critical Environmental Concern

Analytical Question #1

How will alternatives affect the relevant and important resource values of existing and proposed Areas of Critical Environmental Concern?

Analytical Assumptions

- Areas of Critical Environmental Concern require special management attention to protect and/or maintain relevant and important resource values.
- Areas of Critical Environmental Concern require no additional management or mitigation outside the special area to protect relevant and important features.
- Some Areas of Critical Environmental Concern may not be designated under some alternatives, and the relevant and important values will not be protected and/or maintained by special management attention.
- Some Areas of Critical Environmental Concern may not be designated under some alternatives, because the relevant and important values will not need special management attention.

Analytical Methods and Techniques

- Determine if the land allocations (special area designations) and management direction of each alternative protects and/or maintains the important and relevant resource values associated with each existing or proposed special management area.

Step 1: List and map locations of all existing or proposed Areas of Critical Environmental Concern by alternative.

Step 2: Define special management attention needed to protect or maintain specific relevant and important resource values by alternative.

Step 3: Under each alternative, determine if specific management activities or lack of management attention will affect the relevant and important resource values that do not receive special management attention.

Analytical Conclusion

- A description of how land allocations (special area designations) and management direction for each alternative affects important and relevant resource values for each area. The conclusion could also include that, under some alternatives, no special management is needed to protect relevant and important values, and therefore special area designation is unnecessary.

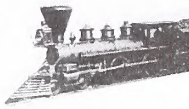
Data Needs

- Map of current and proposed Areas of Critical Environmental Concern.
- Special management attention needed to protect or maintain the relevant and important resource values of individual Areas of Critical Environmental Concern.
- Maps of areas (based on models for each alternative for land use allocation and management direction/action) where management activities will occur.

Data Display

- A table will identify Areas of Critical Environmental Concern designated, and whether or not their relevant and important values are protected. See example table format below.

Comparison of Alternatives Showing Areas of ACEC Designation and Protection of Relevant and Important Values								
Yainax Butte								
Relevant & Important Values	Alternative 1		Alternative 2		Alternative 3		Alternative 4	
Natural processes and systems, including special status plant species.	Designated	Values Protected	Designated	Values Protected	Designated	Values Protected	Designated	Values Protected



Heritage and Paleontological Resources

Analytical Question #1

What are the consequences of the alternatives on the scientific, cultural, recreational, aesthetic, economic, and inspirational values of heritage and paleontological resources?

Analytical Assumptions

- Adverse impacts to heritage and paleontological values occur when sites are disturbed and site material contexts become mixed or churned, materials are damaged, and site integrity is disrupted or destroyed. Change to site setting can also be an adverse impact.

- Sites are not evenly distributed across the landscape or across landforms. Over the past eight years, the most new sites have been found in the Klamath Falls Resource Area, which averages 85.25 new sites recorded per year with a decrease to the north and west. Southern Oregon (Roseburg and Medford Districts) averages 61.5 new sites per year; and North and Coastal Oregon (Eugene, Coos Bay and Salem Districts) average 1.25 new sites per year. Therefore, alternatives will be analyzed by these three zones.

- More than 2,700 sites have been recorded in the planning area. Of these, at least 217 have been found eligible for, or are currently listed, on the National Register of Historic Places (NRHP). The number of sites determined ineligible and the number of sites not evaluated are not available. The total number of sites that will be eligible for the National Register of Historic Places cannot be accurately calculated without information on the numbers of ineligible and unevaluated sites.

- The average number of sites recorded and damaged each year is available. However, each District uses different definitions in reporting completed inventory acres, so the number of acres inventoried each year is not comparable across all districts. Therefore, acres of past activities will be used as a basis for determining site frequency.

- Most impacts can be minimized or eliminated by first discovering sites through pre-disturbance record searches and field inventory and then, if sites are found to be present, by project redesign to achieve site avoidance or use of site- and project-specific mitigation measures.

- Over the last eight years, sites identified pre-disturbance requiring avoidance or mitigation to eliminate adverse effects in the Klamath Falls Resource Area averaged 113 sites per year, in Southern Oregon 26.25 sites per year, and in Northern and Coastal Oregon 1.375 sites per year. However, inadvertent loss of cultural and paleontological sites still occurs. Pre-disturbance inventory does not locate all sites. The extent of an untested site may be misjudged.

- Project-related site damage occurred to 21 sites over the past eight years. This damage occurrence averaged one site per year on the Klamath Falls Resource Area, 1.125 sites per year in Southern Oregon, and 0.5 sites per year in North and Coastal Oregon. The National Register of Historic Places eligibility status (listed, eligible, ineligible or unevaluated) of these sites was not reported.

- The potential for impact on heritage and paleontological resources varies directly with the amount of surface and sub-surface disturbing activity allowed under each alternative within each portion of the planning area (Klamath Falls Resource Area, Southern Oregon as defined above, and North and Coastal Oregon as defined above.)

- No data is available for paleontological resource impacts within the planning area. These sites occur infrequently in the planning area. An assumption that these sites could be impacted in a similar manner as heritage resources is used for this analysis.

Analytical Methods and Techniques

- All alternatives will be relatively ranked for potential impact to heritage and paleontological resources based on the percentage of the land area open to disturbance and the extent to which disturbance is expected to occur within the three areas defined above (Klamath Falls Resource Area, Southern Oregon, and North and Coastal Oregon.)

Analytical Conclusion

- The amount of possible disturbance to heritage and paleontological resources in the three defined areas (Klamath Falls Resource Area, Southern Oregon, and North and Coastal Oregon), as correlated to the amount of ground disturbance resulting from implementation of the different alternatives.

- A ranking of the potential (same as current, more, or less) of alternatives to disturb heritage and paleontological resources.

Data Needs

- Acres of disturbance by district by alternative. This includes activities that cause ground surface, sub-surface, and near surface disturbance; timber harvest; silvicultural treatments such as thinning; new road construction; some habitat restoration activities; and fire treatments.

- Acres of sites by landform is not available at this time.

Data Display

- Narrative and reference to tables and charts that show acres of expected disturbance, extent of area open to off-highway vehicle use, size of riparian reserves, and size of overall reserves by alternative. Alternatives will be ranked as same (no change), less (less ground disturbance than current), and more (more ground disturbance than current.)

Analytical Question #2

What are the consequences of the alternatives on Native American use of traditional materials and religious sites?

Analytical Assumptions

- Religious and traditional material collection and activity sites are not evenly or randomly distributed across the landscape. The total number of these sites is not known.

- Impacts to Native American use of religious sites and traditional material sites include, but are not limited to: alteration of sites and site settings; loss of vehicular access to sites; noise and visual intrusion to the site setting; reduction or elimination of traditional use products such as huckleberries, bark, hazel and other resources; competition for special forest products that tribal members want such as berries, mushrooms, bear grass, firewood or greenery; and damage or disturbance to physical elements of sites such as cairns, mounds or burials.

- The potential for impacting Native American traditional use sites and resources and religious sites and practices varies directly with the amount of disturbance activity allowed under each alternative, as well as the number and location of commercial and free-use permits for special forest products.

- Consulting with Tribal governments and Tribal members early in project planning to identify locations and resources of concern and design mitigation measures (which may include site avoidance, project timing, or preferred management methods) may minimize or eliminate effects.

- Inadvertent loss of traditional sites could still occur. Tribes may not identify all sites and resources of concern. Mitigation measures may not adequately protect the site or resource.

- Currently, no data is available to quantify impacts to Native American traditional use and religious sites and resources within the planning area.

Analytical Methodology and Techniques

- All alternatives will be relatively ranked for potential impact to Native American traditional and religious uses based on the percentage of the land area open to disturbance and the extent to which disturbance is expected to occur on those areas.

Analytical Conclusion

- A ranking of alternatives, showing the amount of disturbance possibility for Native American traditional use and religious sites and resources, based on the amount of ground disturbance associated with implementing management actions in each alternative.

- Alternatives will be ranked according to their potential (same as current, more or less) for disturbing Native American traditional use and religious sites and resources.

Data Needs

- Acres of disturbance by district, by alternative.

Data Display

- Narrative and reference to tables and charts that illustrate the acres of expected disturbance, extent of area open to off-highway vehicle use, size of riparian reserves, and size of overall reserves by alternative. Alternatives will be ranked as same (no change from current level of disturbance), less (less ground disturbance than current), and more (more ground disturbance than current).

Access and Roads

Analytical Question #1

How will the alternatives affect the management, maintenance, and use of BLM's road transportation system?

Analytical Assumptions

- Timber harvest operations would require construction of additional permanent and temporary type roads on BLM and private timberlands.
- Permanent roads would be maintained or improved to design standards that would support anticipated use, provide for safety, and protect adjacent lands and resources.

Analytical Methods and Techniques

- District engineers and the Oregon State Office realty specialist will assess the OPTION model output to determine what level of road use and associated maintenance, and road construction would be needed to support activities under each alternative. The assessment will consist of professional judgment based on district records, local knowledge, and transportation management plans and objectives.

Analytical Conclusions

- Miles of various road maintenance levels, miles of closed roads, miles of decommissioned roads, miles of new construction/improvement by alternative

Data Needs

- Current road inventory (miles) by:
  - Surface type and condition (natural, aggregate, bituminous)
  - Functional classification (collector, local, resource)
  - Standard (single lane, double lane)
- Estimate of miles of proposed permanent or temporary road construction
- Miles of road to be decommissioned, put in a low maintenance condition or gated
- The BLM-managed lands subject to reciprocal right-of-way agreement (estimated acres and location).

Data Display

- Tables showing miles of roads to be decommissioned, closed, extended non-use (low maintenance), and new construction/improvement.

Analytical Question #2

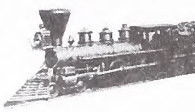
What are the access needs for BLM-managed lands within the planning area?

Analytical Assumptions

- BLM requires legal access to all BLM-administered lands.
- BLM-managed lands accessed via reciprocal right-of-way agreement or nonexclusive easement are not considered as lands legally accessible to the public.

Analytical Methods and Techniques

- BLM district engineers and the BLM Oregon State Office realty specialist will determine the acres and location of all BLM-administered lands without legal BLM access, and BLM-administered lands without legal access for the public. The determination will be based on district records and local knowledge.



Analytical Conclusions

- Acres and location of all BLM-administered lands without legal BLM access and without legal public access.

Data Needs

- District realty records
- District right-of-way agreement files

Data Display

- Map showing BLM-administered lands without legal BLM access.
- Map showing BLM-administered lands without legal access for the public.
- Table showing acres of lands without legal BLM access and without legal public access by district and entire planning area.

References and Citations

- Interim Ground Transportation Theme Update Manual, Fall 1998
- Ground Transportation Data Dictionary, Aug. 2, 2004
- BLM Manual 9113
- BLM Manual Handbook H-2100
- BLM Manual Handbook H-2812

Minerals and Energy

Analytical Question #1

How will each alternative affect: (1) lands/acres available for mineral and energy exploration and development, and (2) accessibility for mineral and energy exploration and development?

Analytical Assumptions

- Mineral exploration and development is governed by statutes and regulations, including 43 CFR Part 3000 and §3100 for Oil and Gas Leasing, §3200 for Geothermal Resource Leasing, §3400 for Coal Management, §3500 for Leasing of Solid Minerals Other than Coal and Oil Shale, §3600 for Mineral Materials Disposal, and §3700 and §3800 for Mining Claims Under the General Mining Laws.

- Strategy for exploration and development of energy resources is contained in the *President's Energy Policy of 2001* and the *Energy Policy Act of 2005*.

- Mineral and energy exploration and development must be carried out consistent with applicable land use plans on lands not otherwise closed or withdrawn from such activities.

- Existing geologic information together with records for mining claims, leasing, authorization for removal of mineral materials, market trends, local and regional economy, and urban/industrial growth will be used to forecast interest in and general location of mineral and energy development.

Analytical Methods and Techniques

- Describe ongoing mineral and energy exploration and development.

- Depict/define acreage available and closed/withdrawn from energy and/or mining claim location, mineral leasing, and authorization for removal of mineral materials by alternative.

- Identify any access changes or restrictions by alternative.

Analytical Conclusion

- Ranking of each alternative based on the foregoing analytical methods emphasizing no change; low, moderate, or high potential for effects; and limitations by plan or stipulations that restrict access to, or the nature of, exploration and development that can be carried out.

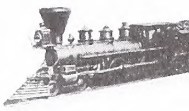
Data Needs

- Local and regional existing and potential energy and mineral exploration and development.
- Acres open and withdrawn for locatable minerals.
- Acres open and withdrawn for leasable minerals.
- Acres open and withdrawn for salable minerals.
- Miles of BLM road closures and/or restrictions.
- Miles of existing BLM roads.

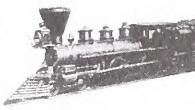
Data Display

- Descriptions/depictions of local and regional existing and potential energy and mineral exploration and development.

- Comparison of each alternative, using tables to illustrate data, and including acres that are open and withdrawn, miles of roads open or closed, and acres subject to planning-based restrictions.



Chapter 4 Consistency with Other Agency Plans and Programs



The BLM planning regulations require that resource management plans be ". . . consistent with officially approved or adopted resource-related plans and the policies and procedures contained therein, of other federal agencies, state and local governments, and Indian tribes, so long as the guidance and resource management plans are also consistent with the purposes, policies, and programs of federal laws and regulations applicable to public lands . . . " (43 CFR 1610.3-2).

Consistency and coordination with other agency laws, regulations and officially approved or adopted natural resource related plans, program and policies will be described within the "BLM Planning and Resource Interrelationships" section of the RMP. This chapter addresses consistency with Federal Agencies; State Agencies and Local Governments; and Tribal Plans and Treaties.

Federal Agencies

In a series of brief narratives, with appropriate cross-references to other RMP/EIS chapter sections and tables, address the consistency of the alternatives with the following entities and their officially approved or adopted plans, programs or policies. Samples of known plans are listed below for each agency.

U.S. Department of Agriculture

- Forest Service
  - Forest-wide land use plans for adjacent national forests.
- Soil Conservation Service
  - Soil Surveys and Watershed Plans
- Animal and Plant Inspection Service
  - Pest Management including noxious weeds

U.S. Department of the Interior

- Fish and Wildlife Service
  - Pacific Bald Eagle Recovery Plan
  - Draft Snowy Plover Recovery Plan
  - Marbled Murrelet Recovery Plan
  - Fish and Wildlife Service determination of critical habitat for northern spotted owl
- National Park Service
  - National rivers inventory and related review procedures

U.S. Department of Defense

- Army Corps of Engineers
  - Applicable project-specific recreation plans and navigable river (Sec. 404) permits

U.S. Department of Energy

- Bonneville Power Administration
  - Transmission and System Facilities Resource Program

U.S. Department of Commerce

- National Marine Fisheries Service
  - Anadromous Fish Recovery Plans and Critical Habitat

Northwest Power Planning Council

- Columbia River Basin, Fish and Wildlife Program, and subordinate species-specific strategies.

State Agencies and Local Governments

State Agencies

A series of brief narratives will be prepared, with appropriate cross-references to other RMP/EIS chapter sections and tables, to address the consistency of the alternatives with the following State of Oregon agencies and their officially approved or adopted plans, programs, or policies. Known plans are listed below for each agency.

Department of Agriculture

- Weed Control Plans
- State-listed endangered plant species

Department of Environmental Quality

- Visibility Protection Plan and air quality standards
- Water Quality Management Plan
- Public use watersheds

Department of Fish and Wildlife

- Statutory Wildlife Policy
- Oregon Endangered Species Programs
- Sensitive Species Rule
- Non-game Wildlife Plan
- Big Game Population Management Objectives
- Comprehensive Wildlife Conservation Strategy
- Oregon Plan for Fish
  Wild Fish Policy
  Coho, Steelhead Trout Plans
- Basin Fish Management Plans

Department of Forestry

- Smoke Management Plan
- Oregon Forest Practices Act
- Forestry Program for Oregon

Water Resources Department

- River basin programs
- Water Resources Commission rules and statutes

Parks and Recreation Department

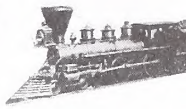
- State-wide Comprehensive Outdoor Recreation Plan
- State Parks and Recreation System Plan
- State Recreation Trails Plan
- State Historic Preservation Program
- Oregon Beach Law
- State-designated Scenic Waterways

Department of Transportation, Highway Division

- Oregon Highway Plan

Division of State Lands

- Removal-fill Law
- Natural Heritage Program



Oregon Department of Land Conservation and Development

State-wide land use planning goals of the Oregon Land Conservation and Development Commission will serve as the analytical foundation for documenting consistency with both state-wide planning goals, approved county and city-wide comprehensive plans, and the Oregon Coastal Management Program. Display the applicable goals by number with a brief description and appropriate discussion or analysis of each goal.

Oregon Coastal Management Program

A separate but closely related analysis of consistency with the Oregon Coastal Management Program should be prepared for each plan. It must be prepared in conformance with 15 CFR 930 and will be officially reviewed by the Oregon Department of Land Conservation and Development. All appropriate State of Oregon agencies will review the coastal zone consistency determination based on the mandatory enforceable policies of the Oregon Coastal Management Program. Publishing it in the RMP/DEIS will allow public review and will facilitate cross references to program or resource-specific environmental consequences.

Local Government

A brief narrative will be prepared for each RMP alternative, addressing its consistency with county and city comprehensive plans. The narrative will note any inconsistencies between RMP alternatives and county plans that might affect RMP implementation. Most counties in the planning area are participating as cooperators in the preparation of the plan to facilitate consistency.

Tribal Plans and Treaties

Separate narrative discussions of any relevant tribal plans, programs or policies, or treaty interests will be included after consulting with appropriate tribal leaders.

Tribes Within the Western Oregon Plan Revisions Planning Area

- Confederated Tribes of the Coos, Lower Umpqua, and Siuslaw Indians
- Coquille Indian Tribe
- Cow Creek Band of Umpqua Tribe of Indians
- Confederated Tribes of Grand Ronde
- Confederated Tribes of Siletz
- Confederated Tribes of the Warm Springs Reservation
- The Klamath Tribes

Opportunities for Coordination Through Cooperating Agency Relationships

The Federal Land Policy and Management Act and the National Environmental Policy Act provide direction regarding coordination and cooperation with other agencies and governments. The Federal Land Policy and Management Act emphasizes the need to ensure coordination and consistency with the plans and policies of other relevant jurisdictions. The National Environmental Policy Act provides for what is essentially a cooperative relationship between a lead agency and cooperating agencies in the National Environmental Policy Act process.

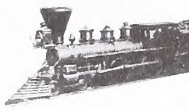
Cooperating agency status provides a formal framework for governmental units—local, state, tribal, or Federal—to engage in active collaboration with a lead Federal agency to implement the requirements of the National Environmental Policy Act. Within the

constraints of time and resources, cooperating agency staff members are encouraged to participate fully with BLM as members of the planning and environmental impact statement team.

The Council on Environmental Policy regulations specify that a Federal agency, state agency, local government, or tribal government may qualify as a cooperating agency because of ". . . jurisdiction by law or special expertise."

1) Jurisdiction by law means ". . . agency authority to approve, veto, or finance all or part of the proposal." (40 CFR 1508.15)
2) Special expertise means ". . . statutory responsibility, agency mission, or related program experience." (40 CFR 1508.26)

Cooperators are important to successful revisions of BLM's resource management plans, and therefore will be involved early and often in the planning process. They can provide expertise in much of the subject matter being analyzed. Some cooperators can provide advice based on experiences with similar planning efforts. Identified cooperators are listed on the following tables.



County Cooperators

- Clackamas
- Columbia
- Coos
- Curry
- Douglas
- Jackson
- Josephine
- Linn
- Klamath
- Lane
- Lincoln
- Marion
- Polk
- Tillamook
- Washington
- Yamhill

State Agency Cooperators

- Governor's Office
- Dept. of Agriculture
- Dept of Environmental Quality
- Dept of Fish & Wildlife
- Dept. of Forestry
- Dept. of Geology and Minerals
- Dept. of Parks and Recreation
- Dept. of State Lands
- State Marine Board
- Dept. of Transportation
- Water Resources Department

Federal Agency Cooperators

- Environmental Protection Agency
- National Marine Fisheries Service
- U.S. Fish & Wildlife Service
- U.S. Forest Service

Chapter 5 Guidance for Use of the Completed Resource Management Plans

This chapter provides guidance on how the plans will be implemented, monitored, evaluated, and changed by the districts.

Understanding the Plan

- Develop an implementation guide on use of the resource management plan.
- Provide training on use of the resource management plan within 90 days of signing its Record of Decision.
- Provide training for new employees within 90 days of starting work.
- Maintain the implementation guide on use of the plan.

Requirement for Further Environmental Analysis

National Environmental Policy Act

Experience in implementing the 1995 western Oregon resource management plans has indicated that improved environmental analysis, particularly for cumulative effects, improved implementation planning, and greater efficiency is achieved when analysis for implementing the resource management plan actions is conducted at the fifth-field watershed level and for multiple years.

In many cases, the analysis of the management situation and the resource management plan environmental impact statement include data, management situations, and environmental effects at the fifth-field watershed level. This sets the stage for subsequent analysis of many resource management plan implementation actions at the fifth-field watershed level for multiple years. It is anticipated that the amount of project-specific or site-specific analysis of implementation actions for this resource management plan will be much reduced compared with the 1995 resource management plans.

Although resource management plans generally do not include activity-level information and analysis specific enough for implementing actions without further NEPA analysis, it is anticipated that for certain actions enough specificity will be included in the resource management plan that they may be implemented with the completion of a Determination of NEPA Adequacy (DNA). A final determination of the appropriate level of subsequent NEPA analysis for implementation of actions under the resource management plan will be made at the completion of analysis of the resource management plan revision. Where subsequent additional NEPA analysis is appropriate for implementation actions, it is anticipated that the analysis in the resource management plan environmental impact statement will in most instances suffice for cumulative effects analysis.

Clean Water Act

Water Quality Management Plans and Water Quality Restoration Plans are required by the Clean Water Act. It is anticipated that the goals and objectives, land use allocations, management direction, and environmental analysis of the resource management plans will contain the required elements of a Water Quality Plan along with the analysis necessary to demonstrate compliance with water quality standards.

Endangered Species Act

Where possible, the goals and objectives, land use allocations, management direction, and environmental analysis of the resource management plans will provide a basis for consultation and a biological opinion under the Endangered Species Act that will reduce the need for further consultation and biological opinions on subsequent implementation

actions. At a minimum, because most analysis of implementation actions will occur at the fifth-field watershed scale and for multiple years, consultation and biological opinions for individual project or site-specific implementation actions will be facilitated.

Monitoring

Requirements for Monitoring

The BLM planning regulations (43 CFR 1610.4-9) call for monitoring and evaluating resource management plans at appropriate intervals.

Monitoring of the resource management plans will consist of three parts:

1. Implementation monitoring to determine if management actions follow RMP direction.
2. Effectiveness monitoring to determine if RMP objectives or desired outcomes are being met or are likely to be met.
3. Validation monitoring to determine if RMP objectives and management actions are based on correct and accurate assumptions.

Monitoring Plan

Each resource management plan will contain a monitoring plan that provides:

- Key monitoring questions
- Standards
- Methods
- Sample size and intervals

Adaptive Monitoring

The monitoring plan will be evaluated at each monitoring interval to ascertain if monitoring questions, standards, methods, sample size, and intervals need to be changed. Key monitoring questions, standards, methods, sample size and intervals may be:

- Modified
- Discontinued
- Added

Changes to the monitoring plan will be accomplished through plan maintenance.

Monitoring Strategy

It is not necessary or desirable to monitor every management action. Monitoring of the resource management plan will be carefully and reasonably designed to avoid prohibitive costs while effectively answering implementation, effectiveness and validation questions.

Key Monitoring Questions

Unnecessary detail and unacceptable costs will be avoided through the use of key monitoring questions. A key monitoring question is a question of high management interest. Most key questions will be designed to provide information to determine whether management direction is being followed or objectives are being met or are likely to be met. The key questions will be accompanied by standards or thresholds by which information will be evaluated. Some key questions will address the status or progress of implementation of certain programs which do not have a specific standards

or thresholds. In these cases, the key question will be for the purpose of determining trends.

Sampling

Unnecessary detail and unacceptable costs will be avoided through the use of sampling. Most monitoring questions will involve sampling. Each key question will be accompanied by the sample size and interval for the monitoring item. Sampling will not necessarily be random or statistically based. Sampling may target projects of high management or public interest. Sampling may target certain projects and areas because they meet a number of monitoring needs including cost efficiency. Sampling will not be specifically designed to distribute monitoring evenly among field offices.

The level and intensity of implementation monitoring (sample size and interval) will vary, depending on the sensitivity and scope of the management action, resource or area being monitored. In cases where past monitoring indicates very high compliance, the monitoring interval and sample size may be adjusted for cost and time efficiency. (From 1995 through 2004, annual implementation monitoring of the western Oregon resource management plans indicated an overall compliance with management direction of approximately 98 to 99 percent while many parts of the resource management plan were implemented with 100 percent fidelity)

Coordination and Consistency

Monitoring of the resource management plan will be conducted at multiple administrative levels and at multiple spatial and temporal scales.

Monitoring of the western Oregon resource management plans will be done in a consistent and coordinated manner to allow district information to be compiled and considered at the scale of the entire western Oregon planning area. Coordination and consistency will be the joint responsibility of each district and the Oregon State Office. Each district will be responsible for the collection, compilation, and analysis of most of the monitoring information. The BLM Oregon State Office will be responsible for coordinating certain effectiveness and validation monitoring.

Monitoring Report

Monitoring results will be reported in a Program Summary and Monitoring Report that will be published at an interval consistent with the monitoring interval of most key monitoring questions. The Program Summary and Monitoring Report will specifically address the questions posed in the monitoring plan. It will report, track and assess the progress of plan implementation; state the findings made through monitoring; and serve as a report to managers and the public.

Designing the Monitoring Plan for the Draft Resource Management Plan

Implementation, effectiveness and validation monitoring will be designed at the same time that individual objectives, management direction and land use allocations are designed for draft resource management plan alternatives. After all of the objectives, management direction, and land use allocations are designed for a particular alternative, the associated monitoring proposals will be reduced to key monitoring questions along with sample methods and monitoring intervals. Thus, each draft resource management plan alternative will have a proposed monitoring plan available for public comment in the draft resource management plan/environmental impact statement.

Plan Evaluation

Plan Evaluation Process

Evaluation is the process of reviewing the land use plan to determine whether plan decisions and NEPA analysis are still valid and whether the plan is being implemented. Land use plans are evaluated to determine if: (1) decisions remain relevant to current issues, (2) decisions are effective in achieving (or making progress toward achieving) desired outcomes, (3) any decisions need to be revised, (4) any decisions need to be dropped from further consideration, and (5) any areas require new decisions.

The plan will be evaluated every 5 years, or as necessitated by changed circumstances or significant new information. Evaluations should be focused on issues resulting from monitoring or new information.

The evaluation will address the following questions:

1. Are management actions outlined in the plan being implemented?
2. Does the plan establish desired outcomes (i.e., goals and objectives)?
3. Are the allocations, constraints, or mitigation measures effective in achieving (or making progress towards achieving) the desired outcomes?
4. Have there been significant changes in the related plans of Indian Tribes, state or local governments, or other Federal agencies?
5. Are there new data or analyses that significantly affect the planning decisions or the validity of the NEPA analysis.
6. Are there unmet needs or new opportunities that can best be met through a plan amendment or revision, or will current management practices be sufficient?
7. Are new inventories warranted pursuant to the BLM's duty to maintain inventories on a continuous basis?
8. Are there new legal or policy mandates as a result of new statutes, proclamations, Executive Orders, or court orders not addressed in the plan?

New Information or Circumstances

New information, updated analyses, or new resource use or protection proposals may require amending or revising land use plans and updating implementation decisions (see Figure 4).

The primary requirements for considering new information are as follows:

- Evaluate if there is new data of significance to the land use and if plan amendments or revisions are required;
- Supplements to a draft or final EIS is required if the agency makes substantial changes in the proposed action that are relevant to environmental concerns, or if there are significant new circumstances or information relevant to environmental concerns and bearing on the proposed action or its impacts; and
- Endangered Species Act regulations require consultation to be reinitiated if new information reveals that decisions may affect listed species or critical habitat in a way or to an extent not previously considered, including exceeding the incidental take for a particular action.

New data or information can include, but is not limited, to:

1. Changes in status, new listings or new critical habitat designations for endangered, threatened, and other special status or sensitive species.
2. Changes in intensity of use or impact levels for a particular resource.
3. Changes in social and economic conditions resulting from urban expansion or broad conservation efforts.

4. Public comment or staff assessments indicating that new information or changed circumstances warrant a reconsideration of the appropriate mix of uses on particular tracts of public lands.
5. A biological opinion issued by the U.S. Fish and Wildlife Service, or by National Marine Fisheries Service, on actions in the planning area.
6. Information from Tribes, elected county officials, state agencies, or other Federal agencies on significant changes in their related plans or resource conditions that are critical to the BLM land use plans and/or subordinate implementation plans.
7. New state listings of water-quality-limited streams [Clean Water Act, Section 303(d)], total maximum daily load (TMDL) developments, or non-attainment area designations (Clean Air Act) that may lead to identification of new management practices that would require additional NEPA compliance and could require new land use plan decisions.
8. New geochemical, geologic, or geophysical data.
9. New cultural resource data.
10. Environmental disturbances that significantly change natural conditions (disturbance examples: wildfires, floods, and noxious weed infestations).
11. Monitoring data and resource assessments associated with implementing resource management actions designed to achieve resource objectives and Land Health Standards.
12. Land use plan evaluations that weigh and interpret information gathered through resource monitoring.
13. Determinations as to whether mitigation measures outlined in the plan are effective.
14. New national policy or a change in legal duties resulting from laws, regulations, Executive Orders, or the BLM directives. An example would be Congressional designation of a river segment under the Wild and Scenic Rivers Act that mandates a protection and enhancement standard that, in turn, may affect resource management objectives, conditions, or uses (such as livestock grazing, timber sales, or other proposed projects) outlined in the land use plan.
15. Information from the public or others regarding conditions or uses of resources on public lands.

Are Changes in Decisions or the Supporting NEPA Analyses Warranted?

The determination whether to amend or revise a resource management plan depends on:

- Nature of new proposals.
- Significance of the new information or circumstances.
- Specific wording of the existing land use plan decisions, including any provisions for flexibility.
- Level and detail of the NEPA analysis.

Revisiting existing decisions and/or the NEPA analysis is appropriate if new information or circumstance provide for interpretations not known or considered at the time existing decisions were made that could significantly affect ongoing actions. This includes the following situations:

1. New information or circumstances provide for interpretations not known or considered at the time existing decisions were made that could significantly affect ongoing actions.

2. New information or circumstances render decisions in the current land use plan invalid for achieving management objectives.

3. Implementation (site-specific) decisions are no longer possible, because new information or circumstances invalidates analysis in the tiered-to land use plan.

4. The effects of proposed or ongoing actions are substantially different from those projected in the existing NEPA analyses associated with the existing resource management plan. Conduct a new or supplemental NEPA analysis to the extent necessary to address the differences, and document the findings. To the extent possible, identify specific thresholds or ranges in the NEPA analysis and resource management plan to inform these subsequent evaluations. Specific steps are explained below:

   - Determine if the additional effect, in the context of the ongoing action, requires further mitigation or new resource management plan decisions.
   - If the environmental effects substantially exceed those predicted in the current resource management plan/environmental impact statement, NEPA analysis supplementing the RMP/EIS would be warranted.
   - If the environmental effects substantially exceed those predicted in the current RMP/EIS *and* are substantially different from what was reasonably foreseeable, *and* the new NEPA analysis could reasonably be expected to result in changes to RMP decisions, a plan amendment may also be warranted.

5. In light of new information or circumstances, are there now inconsistencies between the ongoing action and the resource-related plans of Indian Tribes, state and local governments, or other Federal agencies that render earlier consistency findings invalid? Changes in land use plan decisions through amendment or revision must be accompanied by new consistency determinations.

Plan Conformance

The term "plan conformance" means either that the plan specifically identifies a resource management action, or the action is consistent with the terms, conditions, decisions, and environmental consequences of the approved plan.

Key considerations in making and documenting conformance determinations include the following:

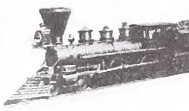
- Do land use plan decisions allow, conditionally allow, or preclude the action?
- Do land use plan decisions call for a new decision to accommodate the action?
- If the plan does not specifically mention the action, how clearly consistent is the action with plan objectives, terms, conditions, decisions, and environmental consequences?

Plan Maintenance

Land use plan decisions can be maintained to reflect minor changes in data. Maintenance is limited to further refining, documenting, or clarifying a previously approved decision. Maintenance must not expand the scope of resource uses or restrictions or change the terms, conditions, and decisions of the approved plan.

Examples of plan maintenance items include:

- Correction of typographical, mapping, or tabular data errors.
- Clarification of an implementation date requirement for a wildlife or botanical survey.
- Clarification of terms.
- Refining the boundary of an archeological district based on new inventory data.



- Refinement and clarification of a Best Management Practice.
- Refinement of an implementation monitoring question or evaluation interval.

Changing the Resource Management Plan

Plan Amendments

Plan amendments change one or more of the terms, conditions, or decisions of an approved land use plan. Plan amendments are most often prompted by the need to:

- Consider a proposal or action that does not conform to the plan.
- Implement new or revised policy that changes land use plan decisions, such as an approved conservation agreement between the BLM and the USFWS.
- Respond to new, intensified, or changed uses on public land.
- Consider significant new information from resource assessments, monitoring, or scientific studies that change land use plan decisions.

Proposals that could result in new or modified resource management plan decisions, or the need to amend the current RMP prior to implementation, should be prepared as an amendment to a resource management plan, whenever feasible.

When possible, the resource management plan will specifically describe the changed conditions (new data, new policies, or circumstances) regarding management objectives/decisions and environmental consequences that would trigger a plan amendment.

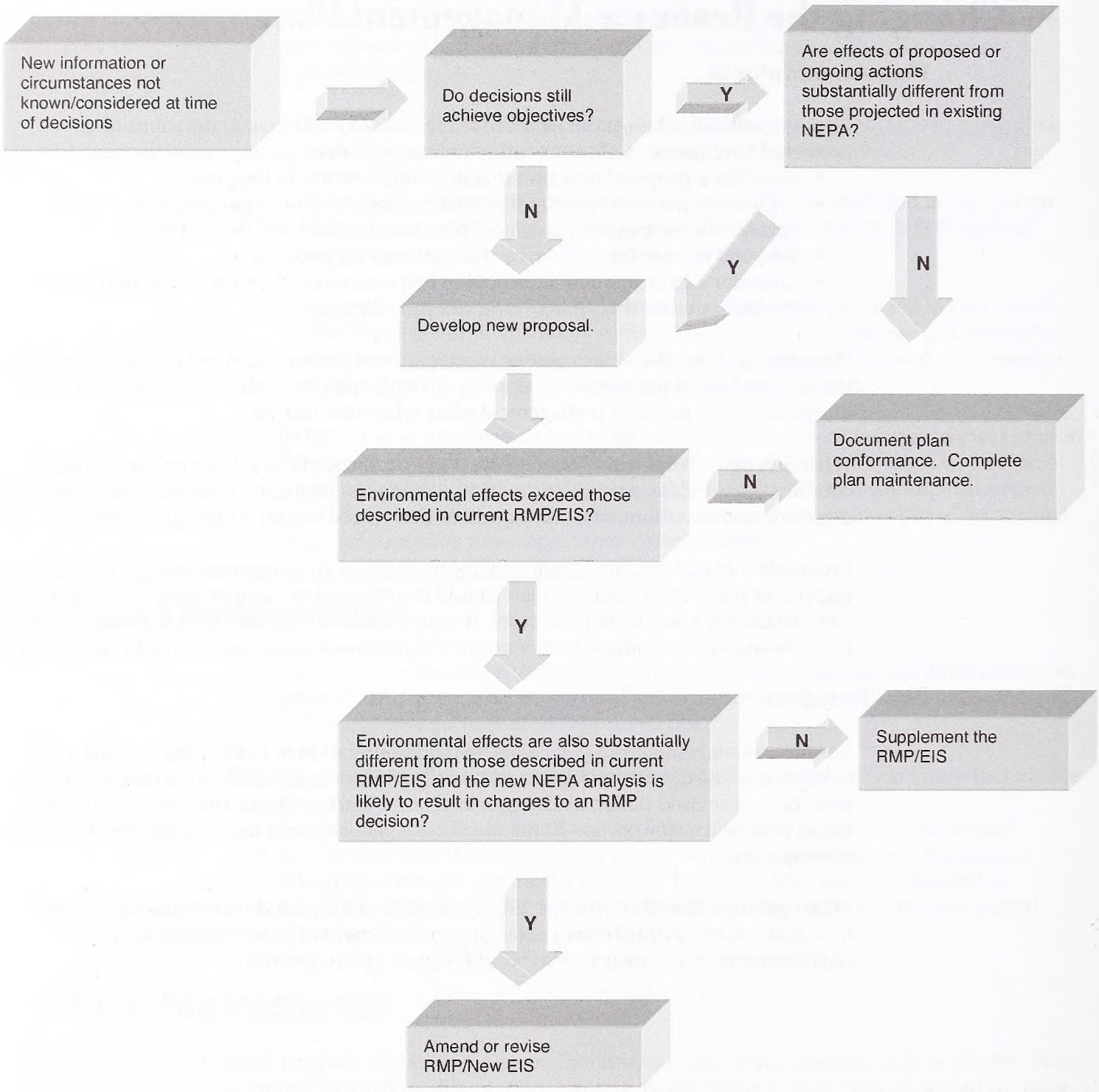
Proposals that address significant new information or circumstances not considered in the EIS for the current land use plan should be prepared as supplements to the EIS for the RMP whenever feasible. In most cases, if a supplement to the RMP/EIS is necessary, the BLM should also consider whether or not a simultaneous plan amendment is necessary.

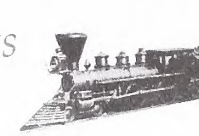
Plan Revisions

Resource management plan revisions involve preparation of a new plan to replace an existing one. RMP revisions are necessary if monitoring and evaluation findings, new data, new or revised policy, or changes in circumstances indicate that decisions for an entire plan or a major portion of the plan no longer serve as a useful guide for resource management.

When possible, the RMP will specifically describe the changed conditions (new data, new policies, or circumstances) regarding management objectives/decisions and environmental consequences that would trigger a plan revision.

Figure 4. Plan Conformance, Amendment, and Revision





Adaptive Management

The Office of Environmental Policy and Compliance issued initial guidance to Department of the Interior agencies on implementing adaptive management practices in NEPA compliance. The guidance defines adaptive management as:

> *. . . a system of management practices based on clearly identified outcomes, monitoring to determine if management actions are meeting outcomes, and, if not, facilitating management changes that will best ensure that outcomes are met or to re-evaluate the outcomes.*

Adaptive management is not a stand alone program or process. Adaptive management for the western Oregon resource management plans will be integrated into NEPA and land use planning processes (See Figure 5). Identified outcomes for the resource management plan are described in the plan's goals and objectives statements. Resource management plan monitoring will determine if the goals and objectives are being met or are likely to be met.

In addition, new information or changed circumstances will be evaluated as to whether changes in resource management plan decisions or supporting NEPA analyses are warranted. The adaptive management tools and procedures to make changes in the plan in response to monitoring information, new information or changed circumstances include plan maintenance, plan evaluations, plan amendments and plan revisions. The use of these planning instruments is described in the previous section. In addition to these planning instruments, NEPA documentation may be necessary. NEPA procedures relevant to adaptive management include the use of categorical exclusions, determination of NEPA adequacy reviews, environmental assessments, and environmental impact statements.

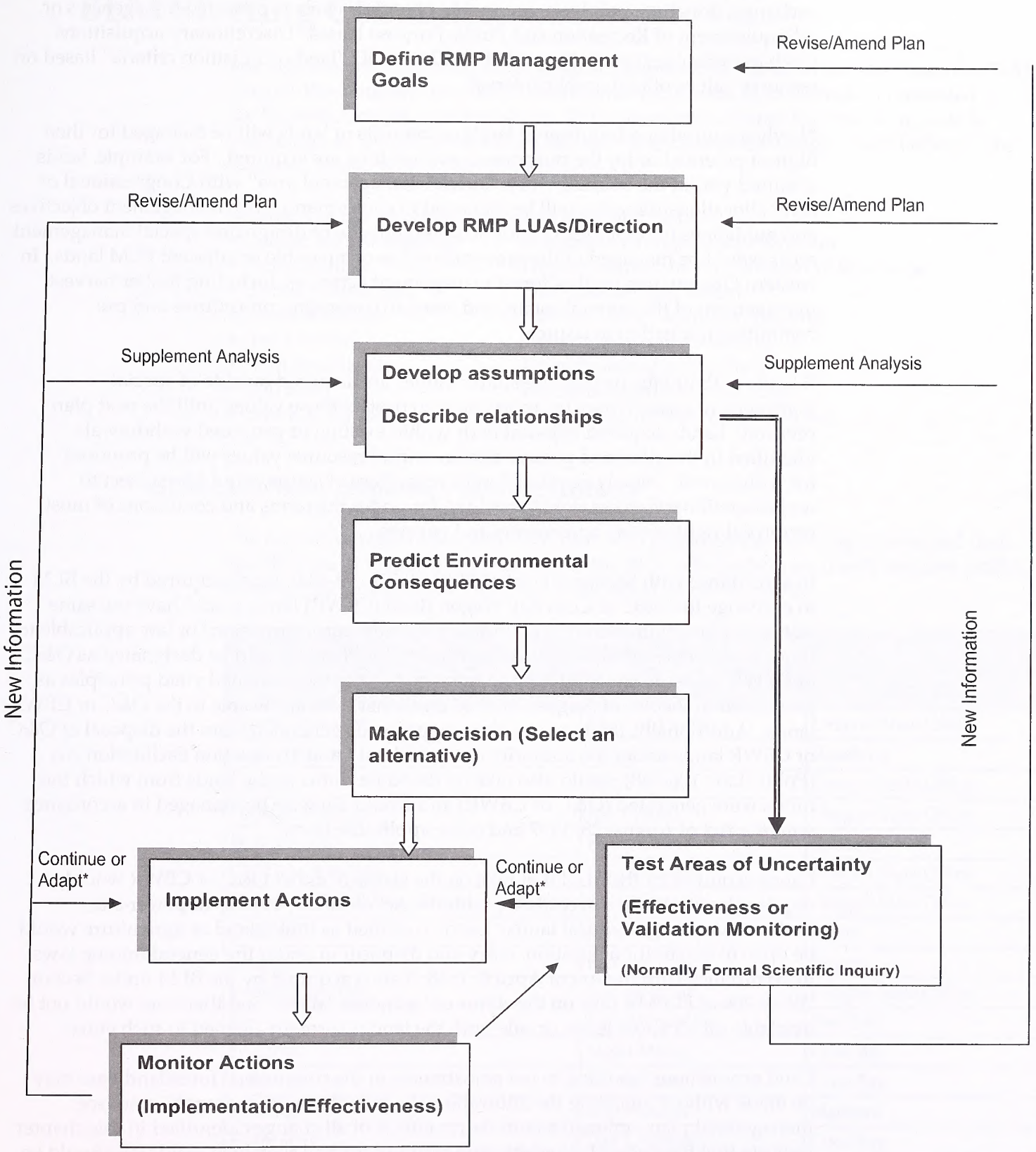
In some instances, management direction in the resource management plan may provide for a range of activities or resource uses. In these cases, levels of activities or resource uses may vary within the range prescribed by the management direction without the use of planning steps or NEPA analyses. The level of activities may be adapted within the range given by management direction, depending on variation in resource needs or organizational capability.

In addition to the constraints or latitude provided by management direction, the ability to adapt or change management without the use of planning steps or NEPA analyses is also restricted by analytical assumptions in the resource management plan environmental impact statement. The conclusions of environmental consequences in the environmental impact statement are derived from the analytical assumptions. Analytical assumptions in the environmental impact statement include such things as levels or methods of activities, number of acres treated, and miles of roads maintained. If, as a result of the need for adaptive management, actual implementation of the resource management plan were to so alter the methods or levels of activities such that the environmental consequences of the plan might be substantively different than those anticipated in the environmental impact statement, then formal planning steps and NEPA procedures could be required. The determination as to when formal planning steps and NEPA procedures are required may be made through the plan evaluation process. Plan evaluations may consist of an overall resource management plan evaluation or they may consist of a narrowly focused evaluation on a specific aspect of the resource management plan.

Valid Existing Rights

Considering the intermingled nature of the O&C lands in the planning area, an immense number of rights-of-way, leases, corridors, and other established legal rights have been granted over the years in establishing an effective cooperative management framework among a variety of owners. Perhaps the most extensive and unique rights are the reciprocal rights-of-way agreements with dozens of adjacent landowners established to provide for the logical, effective, and efficient development of access on the intermingled lands. Mining claims, water rights, and county roads are other examples. When developing alternatives and implementing resource management plans, it is recognized there are some instances when actions that may occur on public lands are subject to these valid existing rights. In those cases, authorization for implementing an action may be subject to approval by the holders of valid existing rights and may not be discretionary to BLM.

Figure 5. Land Use Planning, Monitoring, and Adaptive Management



* When monitoring shows the plan is being implemented as written, continue to implement. Where management direction specifically describes the conditions where adaptation is allowable without supplementing/revising/amending plan then adapt actions.

Additionally, monitoring plan should be informed by areas of uncertainty and sensitivity of assumptions and relationships.

Management of Newly Acquired Lands

Lands may come under BLM administration after completion of the RMP/ROD through exchange, donation, purchase, revocation of withdrawals to other federal agencies or relinquishment of Recreation and Public Purpose leases. Discretionary acquisitions (such as exchanges) are to be guided by RMP/ROD "lands acquisition criteria" based on resource values of high public interest.

Newly acquired or administered lands or interests in lands will be managed for their highest potential or for the purposes for which they are acquired. For example, lands acquired within the boundary of a "special management area" with Congressional or RMP allocations/direction will be managed in conformance with management objectives and guidelines for that area. Lands acquired outside of designated special management areas would be managed in the same manner as comparable or adjacent BLM lands. In western Oregon, this implies forest management activities, including timber harvest, management of the mineral estate, and standard operating procedures and pre-committed mitigation measures.

If lands with unique or fragile resource values are acquired outside of special management areas, it may be appropriate to protect those values until the next plan revision. Lands acquired adjacent to or within existing or proposed withdrawals identified in this plan and possess similar critical resource values will be proposed for withdrawal. Newly acquired lands, regardless of status, would be subject to non-discretionary access rights provided for under the terms and conditions of most reciprocal right-of-way agreements and permits.

In accordance with Section 205 (e) of FLPMA (P.L. 99-632), lands acquired by the BLM in exchange for O&C or Coos Bay Wagon Road (CBWR) lands would have the same status and be administered in accordance with the same provisions of law applicable to those lands disposed of; and those newly acquired lands would be designated as O&C or CBWR lands, as appropriate, and managed under the sustained yield principles as prescribed in the Act of August 28, 1937 and other laws applicable to the O&C or CBWR lands. Additionally, lands acquired using proceeds generated from the disposal of O&C or CBWR lands under the authority of the Federal Land Transaction Facilitation Act (Public Law 106-248) would also take on the same status as the lands from which the funds were generated (O&C or CBWR) and would likewise be managed in accordance with the Act of August 28, 1937 and other applicable laws.

Lands acquired by the BLM that take on the status of either O&C or CBWR would require classification in accordance with the Act of June 9, 1916 as to power-site, timberlands, or agricultural lands. Lands classified as timberland or agriculture would be open to exploration, location, entry and disposition under the general mining laws in accordance with the Act of April 8, 1948. Lands acquired by the BLM under Section 205 or 206 of FLPMA take on the status of "acquired lands," and therefore would not be available for location, lease, or sale until the land is formally opened to such entry.

Land acquisitions resulting in net adjustments in the commercial forestland base may be made without adjusting the allowable sale quantity or amending the resource management plan, unless the cumulative effects of all changes identified in this chapter indicate that the decadal allowable sale quantity for any sustained yield unit should be modified by more than 10 percent.

Appendix A - Key Personnel

BLM Steering Committee

The eight-member Steering Committee is comprised of management staff from the BLM Oregon/Washington State Office in Portland and the six BLM districts represented in the Western Oregon Plan Revisions. This committee's overall function is to provide leadership, on behalf of the BLM west-side districts and the Oregon State Office, to the Resource Management Plan Revisions process.

Members of the Steering Committee are listed below:

- Elaine Marquis-Brong — Oregon/Washington State Director
- Mike Mottice — Deputy State Director, Division of Resources
- Denis Williamson — District Manager, Salem
- Mark Buckbee — Acting District Manager, Eugene
- Jay Carlson — District Manager, Roseburg
- Tim Reuwsaat — District Manager, Medford
- Jon Raby — Field Manager, Klamath Falls
- Mark E. Johnson — Acting District Manager, Coos Bay

BLM Staff Who Prepared Planning Criteria

The following table lists the 24 BLM staff who prepared the planning criteria and their specific area of responsibility, as well as the BLM office where each staff member works. Biographies for each staff member are included below the table.

Key BLM Staff and Assigned Responsibilities

Responsibility	Name	BLM Unit
Project Manager	Richard Prather	Oregon State Office
Lead Planner	Philip Hall	Roseburg
Planner	Anne Boeder	Oregon State Office
Forester/Planner	Alan Wood	Oregon State Office
Writer-Editor	Kathy Helm	Spokane
GIS/Data Analysis	Duane Dippon	Oregon State Office
Vegetation/Land Use Allocation Mapping	Chris Cadwell	Oregon State Office
Cultural	Fran Philipek	Salem
Ecology	Richard Hardt	Eugene
Energy/Minerals	Eric Hoffman	Oregon State Office
Fire	John Dinwiddie	Medford
Fisheries	Nikki Moore	Coos Bay
Fisheries	Bill Hudson	Coos Bay
Grazing	Kim Hackett	Medford
Hydrology	Dan Carpenter	Coos Bay
Recreation	Chris Church	Coos Bay
Roads, Lands	John Styduhar	Oregon State Office
Silviculture	Craig Kintop	Roseburg
Socio-Economic	Christina Caswell	Oregon State Office
Soils	Clif Fanning	Oregon State Office

Key BLM Staff and Assigned Responsibilities		
Responsibility	**Name**	**BLM Unit**
Special Areas	Lou Whiteaker	Klamath Falls
Timber	Dave DeMoss	Eugene
Vegetation/Botany	Doug Kendig	Medford
Vegetation/Botany	Claire Hibler	Salem
Wildlife	Chris Foster	Roseburg

Anne Boeder - *Planner.* Anne holds a B.A. in Cartography and Geography from the University of Wisconsin and a Master of Public Administration from the University of Utah. Anne has 21 years of government service, including 13 years with the U.S. Forest Service and 6 years with the BLM. She most recently served in various leadership roles on the interagency team for the 2004 Survey and Manage Environmental Impact Statement and Record of Decision. She has also worked on both the Roseburg and Coos Bay Districts.

Chris Cadwell - *Forester/Resource Analyst.* Chris served on the Forest Ecosystem Management Assessment Team in the estimation of probable sale quantities. He has coordinated probable sale quantities estimations and geographic information system analysis supporting development and implementation of the BLM resource management plans in western Oregon. He is co-author of the implementation guidance for the 15 percent standard and guideline. Chris served as co-lead in developing interagency vegetation standards and served on the team that developed interagency land allocation standards for the Northwest Forest Plan area. He participated in the Survey and Manage Final Supplemental Environmental Impact Statements in the assessment of timber effects and development of late-successional forest. He is the state data steward for the forest operations inventory, timber production capability classifications, and land use allocations for the BLM. Chris has 25 years experience with the BLM in western Oregon and currently is employed by the BLM Oregon/Washington State Office. He holds a B.S. in Forest Management from Humboldt State University.

Dan Carpenter – *Hydrologist.* Dan has a B.S. in Soil Science, from Washington State University. He has worked as a professional hydrologist, for the past 25 years (12 with the U.S. Forest Service and 13 with the BLM) on the Oregon Coast, Western Cascades and Great Basin in Nevada. His area of expertise includes watershed planning, modeling, and watershed restoration. His most recent assignments included working on an interagency Port-Orford-Cedar Environmental Impact Statement and environmental planning roles in the permitting of the Coos County Natural Gas Pipeline. Dan is currently employed as a hydrologist on the Coos Bay District.

Chris Church – *Recreation, National Landscape Conservation System* – Chris has a B.S. in Wildlife and Fisheries Science from Texas A&M University. He has nine years of experience developing community-based conservation and recreation-related projects with the BLM, University of Oregon, and the U.S. Peace Corps. Chris currently works for the Coos Bay BLM District, managing the Areas of Critical Environmental Concern program.

David DeMoss – *Forester.* Dave is currently the district staff forester and district silviculturist for the Eugene BLM District. He holds a B.S. in Forestry from the University of California - Berkley, and has 29 years experience on the Eugene BLM District in timber sales and silviculture. He served as the silviculturist on the Late Successional Reserve # 267 Restoration Environmental Impact Statement and has experience in stand dynamics and modeling.

John Dinwiddie – *Fire/Fuels/Air Quality.* John's forestry education includes 2 years at Central Oregon Community College and completion of Technical Fire Management in 1989. John worked in private industry for 2 years and for the U.S. Forest Service for 5 years. His BLM employment totals 25 years.

Duane Dippon – *Geographic Information System/Data Team Leader.* Duane earned a B.S. and M.S in Forestry and Forest Economics at Purdue University and a Ph.D. in Forest Management, with a Minor in Operations Research, from Oregon State University. He served as the Forest Ecosystem Management Assessment Team co-Geographic Information System /Data Team Leader, building the geospatial database covering over 24 million acres of federal lands across the Pacific Northwest and used by the Forest Ecosystem Management Assessment Team scientists in the development of the Northwest Forest Plan. Duane came to the Bureau in 1988 to integrate the use of geospatial data, modeling, and geographic information system technology in support of federal land planning. He has served as the chair or co-chair of the Interagency Resources Information Coordination Council from 1994-98 and 2003-04 and serves on the Oregon Geographic Information Council. Prior to joining the BLM, Duane was an Associate Professor at the University of Florida teaching Forest Management, Forest Economics and Quantitative Methods in Natural Resources Management.

Clif Fanning – *Soil Scientist.* Clif holds a B.S. in Soil Science from California Polytechnic State University. He has 32 years of federal service and has been working with the BLM since 1977. Cliff previously worked in Dillon and Butte, Montana; and in Cheyenne, Wyoming. He has served on numerous planning efforts over the years and has been the Oregon/Washington state soil scientist since 1991.

Chris Foster – *Wildlife Biologist.* Chris is currently the District Wildlife Biologist for the Roseburg BLM District. He holds a B.S. in Forest and Wildlife Management from the University of Maine, and an M.S. in Wildlife Management from West Virginia University. Chris has more than 15 years experience working for the U.S. Forest Service and the BLM. Chris has held positions as a Wildlife Biologist and as a forester specializing in watershed analysis and planning.

Kimberly Hackett – *Rangeland Management Specialist.* Kimberly Hackett has a B.S. in Wildlife Science with a Range Science Emphasis from New Mexico State University. She has worked for the BLM for 17 years. Kimberly is currently the Medford BLM District Rangeland Management Specialist. She previously worked as a Rangeland Management Specialist for 11 years in Idaho and 5 years in Nevada.

Phil Hall – *Planner.* Phil holds a B.S. in Forestry and a B.S. in Conservation from North Carolina State University. Phil served on the interdisciplinary team for the Northwest Forest Plan Supplemental Environmental Impact Statement (1994) and was a lead planner in developing the western Oregon resource management plans tiered to the Northwest Forest Plan. He has served on regional teams for the development of watershed analysis guides and monitoring and research. Phil has provided national level training for the National Environmental Policy Act and Resource Management Planning. Phil has a broad understanding and familiarity of BLM programs and plans, including the Northwest Forest Plan and environmental impact statements. He has 33 years of federal service. Phil has been with the BLM since 1976 and has worked on two BLM districts and several resource areas. He has served on special assignments to BLM's national office in Washington, DC and to other BLM districts in the western United States.

Richard Hardt – *Ecologist.* Richard has a B.A. in Natural Sciences from John Hopkins University, an M.L.A in Landscape Architecture from Harvard University, and a Ph.D. in

Forest Resources from the University of Georgia. He has 11 years of experience working for the BLM and is currently employed at the Eugene BLM District. Richard's expertise is in forest ecology, planning, and the National Environmental Polity Act.

Kathy Helm – *Writer-Editor*. Kathy has over two years of college credits and 26 years experience with the BLM in the planning arena, as a writer editor and as a planner and environmental coordinator. She has worked in six BLM offices, as well as the OR/WA state office on statewide environmental documents, including environmental impact statements for wilderness, vegetation management, and land exchanges. Kathy has served on various regional planning teams, providing editorial assistance for the Northwest Forest Plan, Survey and Manage, and Interior Columbia Basin Ecosystem Project. She was the main writer/editor for the Coos Bay BLM District's Resource Management Plan. Kathy is currently the District Planning and Environmental Coordinator for the Spokane BLM District.

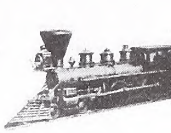
Claire Hibler – *Botanist*. Claire has served as the Lead Botanist for the Salem BLM District since 2001. She holds a B.S. in Forest Management from Oregon State University and a B.A in General Biology from Humboldt State University. Claire was a founding member of and participates on the steering committee for the Northwest Oregon Invasive Weed Management Partnership, which spans the northwest corner of Oregon and part of southwest Washington. She has worked in the Salem BLM District for more than 15 years in the botany and invasive plant programs, at both the resource area and district level.

Eric Hoffman - *Mining Engineer*: Eric holds a B.S. in Geology from Washington State University with additional hours in environmental geology and engineering from Eastern Washington State University and George Washington University in D.C.. He has completed 37 years of government service, including 8 years with the former U.S. Bureau of Mines in Washington state and at headquarters in Washington, D.C.; 9 years with the U.S. Geological Survey at Grand Junction, Colorado; and 20 years with BLM in Oregon/ Washington. Eric's career has encompassed work on mineral resource evaluation, mined land reclamation, and Federal/Indian mineral program management. Eric is currently serving as the Acting Section Chief for the OR/WA State Office Minerals Section.

William F. Hudson – *Fishery Biologist*. Bill has a B.S. in Wildlife Management and a M.S. in Biology (Fisheries) from Tennessee Technological University. He has worked for the BLM for 25 years in the Coos Bay District. Early in his career he worked as a resource area biologist, assisting in fisheries and wildlife management. Currently, Bill is the Coos Bay BLM District Fisheries Biologist and has spent the last 7 years working on various Endangered Species Act consultations with National Oceanic and Atmospheric Administration-Fisheries, including local project consultations and regional consultations at the plan level for the Interior Columbia Basin and the Northwest Forest Plan. Recently, Bill chaired an interstate and interagency team that developed an Analytical Process for Developing Biological Assessments for Federal Actions Affecting Fish within the Northwest Forest Plan Area.

Douglas Kendig – *Botanist/District Native Plant Coordinator*. Doug has 21 years experience with the BLM and 3 years with the Peace Corps in Guatemala. He served as area and district botanist and resource specialist for the last 11 years, representing botany, native plants and restoration. Doug has been a resource area team member on numerous environmental assessments and watershed analysis. He holds a B.A. in International Studies from Southern Oregon University and graduate class work in Botany from Southern Oregon University and the University of Washington.

Craig Kintop – *Forester*. Craig is currently the District Silviculturist for the Roseburg BLM District. He holds a B.S. in Forest Resources Management from the University of



Minnesota. Craig has more than 29 years experience working for the U.S. Forest Service and the BLM. He was a member of the silviculture/inventory team that developed silvicultural prescriptions and growth and yield information for the 1995 resource management plans.

Christina Caswell – *Economist.* Christina has a B.B.A. in Marketing with minors in both Economics and International Business from Boise State University. She has worked as a federal economist for 13 years, working for the Bureau of Labor Statistics, the U.S. Army Corps of Engineers, and most recently as the Oregon/Washington Regional Economist for the BLM for the last three years.

Nikki M. Moore – *Fishery Biologist.* Nikki is currently a fisheries biologist for the Coos Bay District BLM. She holds a B.S. in Fisheries Biology from Oregon State University. She has worked for the BLM and U.S. Forest Service for about 8 years. Nikki also worked for the National Oceanic and Atmospheric Administration-Fisheries where she completed Endangered Species Act biological opinions for local and regional projects.

Frances Philipek – *Archeologist.* Fran holds a B.S. and M.A. in Anthropology from Portland State University. Fran has 28 years of government service, including 7 years with the U.S. Forest Service in Lakeview and Klamath Falls and 21 years with BLM in Idaho, North Dakota, and Oregon. Fran currently is the District Archeologist for the Salem BLM District. She is the state-wide lead for the Heritage Education and project archeology programs.

Dick Prather – *Project Manager.* Dick is a graduate of the Northern Arizona University School of Forestry in Flagstaff, Arizona. He served as team leader for the Final Supplemental Environmental Impact Statement for Survey and Manage in 2001 and 2004. He is a 34-year veteran of the BLM. Prior to his assignments on EIS teams, he was Field Manager in the Salem District for 18 years. He previously worked in Coeur d'Alene, Idaho and Coos Bay, Oregon as a forester.

John Styduhar – *Senior Realty Specialist.* John has a B.S. in Forestry Science from Penn State University. He has worked for the BLM as a forester, area engineer, and realty specialist for 27 years: 10 years in timber sale planning and administration, 5 years in forest road engineering and transportation management, and 12 years as senior realty specialist at the BLM Oregon State Office specializing in public land law administration and O&C lands.

Lou Whiteaker - *Botanist.* Lou is the resource area botanist in the BLM Klamath Falls Field Office. He holds a B.S. in Finance from the University of Southern California and an M.S. in Botanical Sciences from the University of Hawaii. Lou has worked in resource management and plant ecology research in Hawaii, Florida, and Oregon. His 18 years of federal government employment include 15 years with BLM.

Alan Wood – *Planner/Forester.* Alan holds a B.S. in Forestry from the University of Minnesota. He is a 30-year veteran of the BLM and has worked in both Idaho and Oregon. Alan was a forester and Operations Chief in Salmon, Idaho, and worked extensively on fire and fuels issues. He served for 10 years as a Field Manager in the Roseburg BLM District, and most recently as a forester in the BLM Oregon State Office.

Science Team

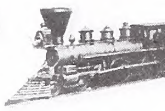
Chapter 2 has a section that addresses the science framework for the plan revisions, including its objectives and strategy. A list of the members of the Science Team, along with their credentials, is provided below.

Sarah Crim – *Forest Economist/Analyst, U. S. Forest Service*
Area of Science Review - Timber harvest scheduling, growth and yield modeling.
Sarah works in the U.S. Forest Service Regional Office in Portland. She has a Ph.D. in Forest Management from the Department of Forestry at Colorado State University and an extensive background in timber harvest scheduling models. She provided guidance for Forest Service planning teams on development and use of timber harvest scheduling models during the forest planning effort prior to the Northwest Forest Plan, and helped develop the timber harvest estimates for National Forests as part of the FEMAT team. Sarah works extensively with National Forests on the NEPA process associated with timber sales, as well as on any litigation that arises.

Doug Drake - *Aquatic Biologist, Oregon Department of Environmental Quality*
Area of Science Review - Water quality and monitoring
Doug has worked for the last 18 years in the Watershed Assessment Section of the Laboratory Division at the Oregon Department of Environmental Quality. His most recent projects relevant to the BLM Science Team include: developing RIVPACS predictive model for state-wide stream assessment using macroinvertebrates; developing a draft wadeable stream sediment benchmark for use in Impaired Waters report (303-d listing process); team leader for data analysis and stressor tool development using probabilistic and targeted sampling approaches; serving on Oregon DEQ Numeric Biological Criteria Technical Advisory Committee; and serving on EPA National Sediment Criteria Workgroup.

Joan Hagar – *Wildlife Ecologist, U.S. Geological Survey*
Area of Science Review: Wildlife ecology
Joan works at the USGS Forest and Rangeland Ecosystem Science Center in Corvallis, Oregon. She has an M.S. and a Ph.D. in Forest Ecology from the Department of Forest Science at Oregon State University. In doing the research for both of these degrees, Joan investigated wildlife-habitat relationships in managed forests, specifically addressing the response of songbirds and their food resources to commercial thinning and partial harvesting in western Oregon. In addition to the research for academic degrees, Joan has worked extensively for the past 15 years with forest managers, silviculturists, and biologists on research projects and problem analyses in Pacific Northwest forests.

Chris Jordan - *Research Biologist, National Marine Fisheries Service*
Area of Science Review: Fish biology
Chris is stationed at the Northwest Fisheries Science Center. His current work primarily involves design and implementation of large-scale monitoring programs to assess anadromous salmonid freshwater habitat and population status, as well as the watershed-scale effect of management actions on salmonid habitat and population processes. The research component of these projects is the development of novel monitoring methods, including sampling designs, metrics and indicators, to address specific data and information needs for managing ESA-listed Pacific Northwest salmonid populations. To support the broad-scale application of monitoring research and the analysis of monitoring data, Chris is developing a landscape classification scheme for watersheds of the Pacific Northwest. The scheme is based on immutable geomorphic and climatic characteristics, as well as anthropogenic impacts. And finally, to test the relevance of current and future monitoring programs, he is collaborating with co-

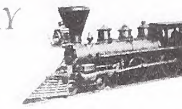


manager groups to evaluate ongoing status and effectiveness monitoring programs based on management decisions these programs support.

Tom Spies - *Research Forester, U.S. Forest Service.*
Area of Science Review: Forest ecology and landscape ecology.
Tom works for the Pacific Northwest Research Station, based in Corvallis, Oregon, and is also professor (courtesy) in the Department of Forest Science, Oregon State University. Since completing his Ph.D. at the University of Michigan in 1983, he has worked in western Oregon and Washington on a wide variety of forest ecology issues, including characterization and definition of old-growth forests. He was a participant in FEMAT and is currently co-team leader of CLAMS (Coastal Landscape Analysis and Modeling Study). His active research includes integrated regional models for ecological and socio-economic assessments; indicators of biological diversity in forest landscapes; old-growth characteristics and conservation; riparian forest ecology; gap dynamics; and applications of remote sensing to ecosystem management.

Fred Swanson – *Research Geologist,U.S. Forest Service.*
Area of Science Review: Geology, landscape ecology, and watershed processes.
Fred is assigned to the Pacific Northwest Research Station, based in Corvallis, Oregon, and is also professor (affiliate) in the Departments of Geosciences and Forest Science, Oregon State University. Since completing his Ph.D. in Geology at the University of Oregon in 1972, he has worked at the H.J. Andrews Experimental Forest and elsewhere in the Northwest on a wide variety of watershed and ecosystem topics. His main focus has been with natural and management disturbance processes in forest and stream systems. Experiences relevant to participation on the BLM Science Team include: long-term, close working relationship with federal forest managers, most notably through the Central Cascades Adaptive Management Area; participant in FEMAT; co-organizer and co-editor of a conference and book on bioregional assessments (Island Press 1999) and deep involvement in interdisciplinary ecosystem research over more than three decades.

John Cissel – *Western Oregon BLM Science Coordinator*
Role on Science Team - Team Leader, Science Coordination
John works for the BLM-Oregon State Office and also holds an affiliate faculty appointment in the Department of Forest Science at Oregon State University. He is responsible for connecting the western Oregon BLM districts to science by integrating management needs into research projects, developing management studies to address management questions, sharing recent science findings with managers, and by developing and demonstrating applications of new science concepts and findings. John has worked in a science-management interface role for the last 15 years, and has particular experience with landscape analysis and planning. John is responsible for science support to the western Oregon BLM RMP revisions.



Appendix B - Glossary

Active instream restoration - Placing logs into a stream to restore structure.

Adaptive Management Area - A Land Use Allocation used in the Northwest Forest Plan. Landscape units designated for development and testing of technical and social approaches to achieving desired ecological, economic, and other social objectives.

Allowable Sale Quantity (or allowable cut) - The gross amount of timber volume, including salvage, that may be sold annually from a specified area over a stated period of time in accordance with the management plan.

Anadromous fish - Fish that are born and reared in freshwater, move to the ocean to grow and mature, and return to freshwater to reproduce.

Analytical assumption - The science and relationships of the natural systems that will be used in analysis of the alternatives.

Animal Unit Month (AUM) - The amount of forage necessary for the sustenance of one cow or its equivalent for 1 month.

Aquatic Conservation Strategy - A component of the Northwest Forest Plan. Designed to restore and maintain the ecological health of watersheds and aquatic ecosystems through Riparian Reserves, Key Watersheds, watershed analysis, and watershed restoration.

Aquatic habitat - Habitat that occurs in free water.

Area of Critical Environmental Concern (ACEC) - Lands where special management attention is needed to protect and prevent irreparable damage to important historic, cultural, or scenic values, fish, and wildlife resources or other natural systems or processes or to protect life and provide safety from natural hazards.

Backcountry byway - A road segment designated as part of the National Scenic Byway System.

Beneficial use - In water use law, reasonable use of water for a purpose consistent with the laws and best interest of the people of the state. Such uses include, but are not limited to, the following: instream, out of stream, and ground water uses, domestic, municipal, industrial water supply, mining, irrigation, livestock watering, fish and aquatic life, wildlife, fishing, water contact recreation, aesthetics and scenic attraction, hydropower, and commercial navigation.

Best Management Practices (BMPs) - Methods, measures, or practices designed to prevent or reduce water pollution. Usually, BMPs are applied as a system of practices rather than a single practice.

Biological Opinion (ESA) - The document resulting from formal consultation that states the opinion of the Fish and Wildlife Service or National Marine Fisheries Service as to whether or not a federal action is likely to jeopardize the continued existence of listed species or results in destruction or adverse modification of critical habitat.

Biomass - A renewable source of energy derived from plant materials.

Board foot (BF) - Lumber or timber measurement term. The amount of wood contained in an unfinished board 1 inch thick, 12 inches long, and 12 inches wide.

Breeding, nesting, roosting, foraging habitat - The vegetation with the age class, species composition, structure, sufficient area, and adequate food source to meet some or all of the life needs of specific species.

Bureau Assessment Species - Plant and animal species on list 2 of the Oregon Natural Heritage Data Base, or those species on the Oregon List of Sensitive Wildlife Species (OAR 635-100-040), which are identified in Bureau of Land Management Instruction Memo No. OR-91-57, and are not included as federal candidate, state listed, or Bureau sensitive species.

Bureau Sensitive Species - Plant or animals species eligible for federal listed, federal candidate, state listed, or state candidate (plant) status, or on list 1 in the Oregon Natural Heritage Data Base, or approved for this category by the BLM State Director. Species included under agency species conservation policies.

Checkerboard ownership - A land ownership pattern in which every other section (square mile) is in federal ownership as a result of federal land grants to early western railroad companies.

Closed canopy - The degree to which the canopy (forest layers above one's head) blocks sunlight or obscures the sky. It can only be accurately determined from measurements taken under the canopy to account for openings in the branches and crowns.

Coarse woody debris/downed woody debris - Portion of a tree that has fallen or been cut and left in the woods. Usually refers to pieces at least 20 inches in diameter.

Colluvial - A deposit of rock fragments and soil material accumulated at the base of steep slopes as a result of gravitational action.

Commercial thinning - Removal of generally merchantable trees from an even-aged stand, usually to encourage growth of the remaining trees.

Connectivity/diversity blocks - Subdivision of the Matrix Land Use Allocation. Managed to maintain 25-30 percent of each block in late-successional forest at any point in time. Intended to maintain connectivity between late-successional/old growth forest areas for breeding, feeding, dispersal, and movement of late successional/old growth related species.

Conservation Strategy - A management plan for a species, group of species, or ecosystem that prescribes standards and guidelines that if implemented provide a high likelihood that the species, groups of species, or ecosystem, with its full complement of species and processes, will continue to exist well-distributed throughout a planning area.

Consultation - A formal interaction between the U.S. Fish and Wildlife Service and another federal agency when it is determined that the agency's action may affect a species that has been listed as threatened or endangered or its critical habitat.

Convection - Transfer of heat by the automatic circulation of fluids.

Coos Bay Wagon Road (CBWR) Lands - Public lands granted to the Southern Oregon Company and subsequently reconveyed to the United States.

Critical Habitat - Under the Endangered Species Act, critical habitat is defined as: (1) the specific areas within the geographic area occupied by a federally listed species on which are found physical and biological features essential to the conservation of the species, and that may require special management considerations or protection; and (2) specific areas outside the geographic area occupied by a listed species, when it is determined that such areas are essential for the conservation of the species.

Crown - Upper part of a tree or other woody plant that carries the main system of branches and the foliage.

Cruise (timber) - Gathering of forest inventory data (such as tree species and volumes) in the field.

Cubic foot - A unit of solid wood, one foot square and one foot thick.

Cumulative effect - The impact on the environment that results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency or person undertakes such other actions. Cumulative impacts can result from individually minor, but collectively significant actions taking place over a period of time.

Debris flow - A rapid moving mass of rock fragments, soil, and mud, with more than half of the particles being larger than sand size.

Density management - In Bureau of Land Management draft planning documents of 1992, the cutting of trees for the primary purpose of widening their spacing so that growth of remaining trees can be accelerated. The Bureau also plans to use density management to improve forest health, to open the forest canopy, or to accelerate the attainment of old-growth characteristics if maintenance or restoration of biological diversity is the objective.

Dispersal habitat - Northern spotted owl habitat description. Forest stands with average tree diameters of greater than11 inches, and conifer overstory trees having closed canopies (greater than 40 percent canopy closure) with open space beneath the canopy to allow owls to fly.

Disturbance (natural) - A force that causes significant change in structure and/or composition through natural events such as fire, flood, wind, or earthquake, mortality caused by insect or disease outbreaks, or by human-caused events such as the harvest of forest products.

Endangered species - Any species of plant or animal defined through the Endangered Species Act as being in danger of extinction throughout all or a significant portion of its range, and published in the Federal Register.

Environmentally Preferred Alternative - Term used in the Council on Environmental Quality's implementing regulations of the National Environmental Policy Act (NEPA). The alternative that will promote the national environmental policy as expressed in NEPA's Section 101. Ordinarily, this means the alternative that causes the least damage to the biological and physical environment.

Extensive Recreation Management Areas (ERMAs) - All public lands outside Special Recreation Management Areas that are within a Resource Area. These areas may include developed and primitive recreation sites with minimal facilities.

Fifth-field watershed - Individual watershed within a Hydrologic Unit as defined by the U.S. Geological Survey. Typically averages 87,000 acres in size. Provides a useful scale for assessing water-related issues.

Fire Regime Condition Class - An interagency, standardized tool for determining the degree of departure from reference condition vegetation, fuels and disturbance regimes. Assessing FRCC can help guide management objectives and set priorities for treatments.

Floodplain - Level lowland bordering a stream or river onto which the flow spreads at flood stage.

Forage - All browse and herbaceous foods available to grazing animals, including wildlife and domestic livestock.

Forest canopy - The more or less continuous cover of branches and foliage formed collectively by crowns of adjacent trees and other woody growth.

Forest Ecosystem Management Assessment Team (FEMAT) -As assigned by President Clinton, this team of scientists, researchers, and technicians from seven federal agencies created a report that was used as the basis for the Northwest Forest Plan.

Forest Operations Inventory (FOI) - An intensive inventory that provides managers with information regarding age, species, stand location, size, silvicultural needs, and recommended treatment based on individual stand conditions and productivity.

Geomorphic - Relating to the form of the earth or its surface features.

Gravel interstitial space - The pockets between pieces of gravel.

Ground-based harvest system - Harvesting timber through the use of mechanical equipment that moves along the ground.

Growth and yield modeling - Estimates of timber volumes expected to be produced under a certain set of conditions.

Habitat-capable forests - Forested stands capable of developing into suitable spotted owl habitat.

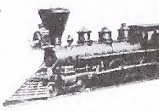
Helicopter logging - Use of helicopters to transport logs from where they are felled to a landing.

Herbaceous vegetation - Seed-producing annual, biennial, or perennial vegetation that does not develop persistent woody tissue, but dies down at the end of a growing season.

Heritage resource - Archeological, historic, architectural, or traditional use site or property.

Historic range of variability - The range of critical ecological processes and conditions that have characterized particular ecosystems over specified time periods and under varying degrees of human influences.

Intermittent stream - A stream that flows most of the time, but occasionally is dry or reduced to pools.



Intensive forest management practices - The growth-enhancing practices of release, pre-commercial thinning, commercial thinning, and fertilization, designed to obtain a high level of timber volume or quality.

Intensively managed timber stands - Forest stands managed to obtain a high level of timber volume or quality through investment in growth-enhancing practices, such as pre-commercial thinning, commercial thinning, and fertilization.

Interagency Vegetation Mapping Project (IVMP) - Combines remotely sensed satellite imagery with Forest Service, BLM, and Forest Inventory and Analysis (FIA) inventory plot field data and plot photo interpreted information to produce existing vegetation maps. Products include canopy cover maps for conifer, broadleaf, and combined vegetation, and size (quadratic mean diameter).

Intrinsic potential (stream) - A stream's inherent ability to provide high quality habitat for salmonids.

Invasive species (plant) - An alien plant species whose introduction does, or is likely to, cause economic or environmental harm or harm to human health.

Jeopardy - A finding made through consultation under the Endangered Species Act that the action of a federal agency is likely to jeopardize the continued existence of a threatened or endangered species.

Key Watershed - A Land Use Allocation used in the Northwest Forest Plan. A watershed containing: (1) habitat for potentially threatened species or stocks of anadromous salmonids or other potentially threatened fish, or (2) greater than 6 square miles with high-quality water and fish habitat.

Ladder fuel - Material on or near the ground that will carry fire to the crown of a tree.

Landscape - A heterogeneous land area with interacting ecosystems that are repeated in similar form throughout.

Land use allocation - Uses that are allowed, restricted, or prohibited for a particular area of land. A type of decision in a land use plan.

Late-Successional, Old-Growth (LSOG) Habitat - A forest in its mature or old-growth stage.

Late-Successional Reserve - A Land Use Allocation used in the Northwest Forest Plan. A forest in its mature and/or old-growth stages that has been reserved from programmed timber harvest.

Large woody debris - Pieces of wood larger than 10 feet long and 6 inches in diameter, in a steam channel.

Mass wasting - The downslope movement of earth materials caused by gravity. This is an all inclusive term that includes, but is not limited to: landslides, rock falls, debris avalanches, and creep. It does not, however, include surface erosion by running water.

Matrix - A Land Use Allocation used in the Northwest Forest Plan. Federal lands outside of reserves, withdrawn areas, and Managed Late-Successional areas.

Minimum harvest age - The lowest age of a stand to be scheduled for final harvest.

Monitoring - The review on a sample basis, of management practices to determine how well objectives are being met, as well as the effects of those management practices on the land and environment.

National Landscape Conservation System - Special Congressional or Presidential land use designations such as National Monuments, Wild and Scenic Rivers, and Wilderness Areas.

Neotropical bird species - Birds that breed and nest in North America, but migrate each fall to warmer climates in tropical regions of Mexico, Central America, South America, and the Caribbean.

O&C lands - Public lands granted to the Oregon and California Railroad Company and subsequently revested to the United States.

Off-Highway Vehicle (OHV) - Any motorized track or wheeled vehicle designed for cross-country travel over any type of natural terrain.

Off-highway vehicle designation - Designation of lands for use of off-highway vehicles.

Open: All types of vehicle use is permitted at all times, anywhere in the area subject to certain operating regulations and vehicle standards.

Limited: Restricted at certain times, in certain areas, and/or to certain vehicular use.

Closed: Off-road vehicle use is prohibited.

Old growth - Older forests occurring on western hemlock, mixed conifer, or mixed evergreen sties which differ significantly from younger forest in structure, ecological function and species composition. Old growth characteristics begin to appear in unmanaged forests at 175 – 250 years of age. These characteristics include: (1) patchy, multi-layered canopy with trees of several age classes; (2) the presence of large living trees; (3) the presence of large dead trees (snags) and down woody debris, and (4) the presence of species and functional processes which are representative of the natural community.

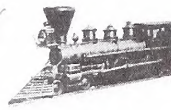
For purposes of inventory, old-growth stands on BLM-administered lands are only identified if they are at least 10 percent stocked with trees of 200 years or older and are 10 acres or more in size. For purposes of habitat or biological diversity, the BLM uses the minimum and average definitions provided by the Pacific Northwest Experiment Station publications 447 and GTR – 258/. This definition is summarized from the 1986 interim definitions of the Old Growth Definitions Task Group.

Operations Inventory (OI) - An intensive inventory that provides managers with information regarding stand location, size, silvicultural needs, and recommended treatment based on individual stand conditions and productivity.

Paleontological resource - Remnants of life from past geological ages as seen in fossil plants and animals.

Peak flow - The highest amount of stream or river flow occurring in a year, or from a single storm event.

Perennial stream - A stream that typically has running water on a year-round basis.



Physiographic province - A geographic area having a similar set of biophysical characteristics and processes due to effects of climate and geology which result in patterns of soils and broad-scale plant communities. Habitat patterns, wildlife distributions, and historical land use patterns may differ significantly from those of adjacent provinces.

Precommercial thinning - An action taken in a nonmerchantable stand of immature trees to control density and growing space, so that growth is concentrated on potential crop trees.

Preferred Alternative - Term used in the Council on Environmental Quality's implementing regulations of the National Environmental Policy Act (NEPA). Agencies are required to declare the alternative that is preferred over the other alternatives. This may be done in the Draft or final Environmental Impact Statement.

Prescribed fire - A fire burning under specified conditions that will accomplish certain planned objectives. The fire may result from planned or unplanned ignitions.

Present net value - A traditional economic valuation method. Determines the present value in "today's dollars" of the future net cash flow of a project.

Public domain lands - Original holdings of the United States never granted or conveyed to other jurisdictions, or reacquired by exchange for other public domain lands.

Public water system - A system providing piped water for public consumption.

Rearing habitat - Areas in rivers or streams where juvenile salmon and trout find food and shelter to live and grow for a period of time.

Recovery plan - A plan for the conservation and survival of an endangered species or a threatened species listed under the Endangered Species Act, for the purpose of improving the status of the species to the point where listing is no longer required.

Regeneration harvest - Timber harvest conducted with the partial objective of opening a forest stand to the point where favored tree species will be reestablished.

Relevant and Important Resource Value – Criteria used to evaluate nominated Areas of Critical Environmental Concern.

Reserved land - Federal lands that have been withdrawn from acreage used for timber yields. These lands often have a preservation or protection status. Wildernesses, Research Natural Areas, and National Recreation Areas are examples of reserved lands.

Resource Management Plan (RMP) - A land use plan as described by the Federal Land Policy and Management Act.

Right-of-Way - A permit or an easement that authorizes use of public lands for certain specified purposes, commonly for pipelines, roads, telephone lines, electric lines, reservoirs, and so on; also, the lands covered by such an easement or permit.

Riparian area - A geographic area containing an aquatic ecosystem and adjacent upland areas that directly affect it. This includes floodplain, woodlands, and all areas within a horizontal distance of approximately 100 feet from the normal line of high water of a steam channel or from the shoreline of a standing body of water.

Riparian Reserve – A Land Use Allocation used in the Northwest Forest Plan. Designated riparian areas found outside the Late-Successional Reserves.

Rotation age - The age of a stand when harvested at the end of a rotation.

Sawlog - A log considered suitable in size and quality for producing lumber.

Sensitivity analysis - A process of examining specific tradeoffs that would result from making changes in single elements of a plan alternative.

Seral Stages - The series of relatively transitory plant communities that develop during ecological succession from bare ground to the climax stage.

Silvicultural practices (or treatments or system) - The set of field techniques and general methods used to modify and manage a forest stand over time to meet desires conditions and objectives.

Silvicultural prescription - A professional plan for controlling the establishment, composition, constitution, and growth of forests.

Site Class - A forest management term denoting site productivity and measured in productivity classes (example: Site Class I - highest productivity).

Skyline cable system - Harvesting timber through the use of a machine that reaches out a long distance to lift logs off the ground and move them via a cable to a landing where they are hauled away.

Slash - The branches, bark, tops, cull logs, and broken or uprooted trees left on the ground after logging has been completed.

Slope stability - The resistance of a natural or artificial slope, or other inclined surface, to failure by landsliding (mass movement).

Snag - Any standing dead, partially-dead or defective (cull) tree at least 10 inches in diameter at breast height and at least 6 feet tall. A hard snag is composed primarily of sound wood, generally merchantable. A soft snag is composed primarily of wood in advanced stages of decay and deterioration, generally not merchantable.

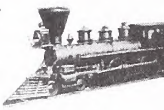
Soil compaction - An increase in bulk density (weight per unit volume) and a decrease in porosity (particularly macropores) resulting from applied loads, vibration or pressure.

Soil productivity - Capacity or suitability of a soil, for establishment and growth specified crop or plant species.

Special Recreation Management Area (SRMA) - Area where a commitment has been to provide specific recreation activity and experience opportunities. These areas usually require a high level of recreation sites, but recreation sites alone do not constitute SRMAs.

Special status species - Plant or animal species in any of the following categories:

- Threatened or endangered species
- Proposed threatened or endangered species
- Candidate species
- State-listed species
- Bureau sensitive species
- Bureau assessment species



Stand conversion - Converting one type of timbered stand to another type of timbered stand. Typically refers to converting hardwood stands to conifer stands.

State-Listed Species - Plant or animal species listed by the State of Oregon as threatened or endangered pursuant to ORS 496.004, ORS 498.026, or ORS 564.040.

Statewide Comprehensive Outdoor Recreation Plan (SCORP) - A plan that describes and analyzes the organization and function of the outdoor recreation system of the State. Prepared by the State, the plan provides an analysis of the roles and responsibilities of major outdoor recreation suppliers; an analysis of demand, supply and needs; issue discussions; an action program to address the issues; and a project selection process.

Stand Condition Classes - A description of the physical properties of a stand such as crown closure or diameters.

Stream morphology - The physical dimensions of the stream channel, including bed and bank material.

Stream order - A hydrologic system of stream classification. Each small unbranched tributary is a first order stream. Two first order streams join to make a second order stream. A third order stream has only first and second order tributaries, and so forth.

Stream reach - An individual first order stream or a segment of another stream that has beginning and ending points at a stream confluence. Reach end points are normally designated where a tributary confluence changes the channel character or order. Although reaches identified by BLM are variable in length, they normally have a range of 0.5 mile to 1.5 miles in length unless channel character, confluence distribution, or management considerations dictate variance.

Stumpage price - The value of standing timber.

Sub-alternative - Adding or removing an element of an alternative to analyze the effects of that action without developing an entirely new alternative.

Sustainable Harvest Land Base - Those lands on which the determination and declaration of the Annual Productive Capacity / Allowable Sale Quantity (ASQ) is based. The ASQ is based on implementing a set of programmed timber management activities that assumes those practices will be repeated over time and results in a sustainable harvest level.

Sustained yield - Term used in the O&C Act of 1937. The yield that a forest can produce continuously at a given intensity of management. A non-declining, even flow.

Timber harvest operability - Economics and feasibility of harvesting a particular tract of forest.

Timber production capability classification (TPCC) - The process of partitioning forest land into major classes indicating relative suitability to produce timber on a sustained yield basis.

Timber volume - Amount of timber contained in a log or a stand. Typically measured in board feet or cubic feet.

Threatened species - Those plant or animal species likely to become endangered species throughout all or a significant portion of their range within the foreseeable future. A

plant or animal identified and defined in accordance with the 1973 Endangered Species Act and published in the Federal Register.

Vegetation class - Classifying vegetation according to specific criteria. The major classes used in the Western Oregon Plan Revisions are non-forest and forest. Forested stands (conifer, hardwood, or mixed) are further described as follows:

1) *Stand Establishment*
   - Without Structural Legacies
   - With Structural Legacies

2a) *Young High Density*
   - Without Structural Legacies
   - With Structural Legacies

2b) *Young Low Density*
   - Without Structural Legacies
   - With Structural Legacies

3) *Mature*
   - Single Canopy
   - Multiple Canopy
   - (In Ponderosa Pine, Grand Fir, and Douglas-fir series: Dense Understory/Open Understory)

4) *Structurally Complex*
   - Existing Old Forest
   - Existing Very Old Forest
   - Developed Older Forest Structure
   - Developed Very Large Older Forest Structure
   - (In Ponderosa Pine, Grand Fir, and Douglas-fir series: Dense Understory/Open Understory)

Visual resource management (VRM) - The inventory and planning actions to identify values and establish objectives for managing those values and the management actions to achieve those objectives.

Visual Resource Management classes - Categories assigned to public lands based on scenic quality, sensitivity level, and distance zones. There are four classes. Each class has an objective that prescribes the amount of change allowed in the characteristic landscape.

Water quality - The chemical, physical, and biological characteristics of water with respect to its suitability for a particular use.

Watershed - The divide separating one drainage area from another. The term "watershed" is commonly used to refer to an area; specifically, the area in which all surface waters flow to a common point.

Wildland Fire - Any non-structure fire, other than prescribed fire, that occurs in the wildland.

Wildland urban interface (WUI) - Areas where communities are expanding into traditional forest and other resource lands.

Windthrow - A tree or trees uprooted or felled by the wind.

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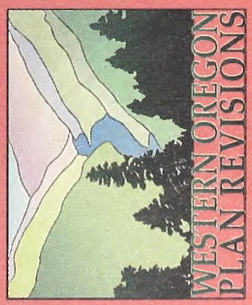

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